FEB 24 1925

PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

THE GEOGRAPHICAL JOURNAL

Vol. LXV No. 2 February 1925

Yugoslav–Hungarian Boundary Commission . Lieut.-Colonel D. Cree 89
The Deserts of Jafura and Jabrin . . . Major R. E. Cheesman 112
Irrigation in the Indo-Gangetic Plain . . . A. V. Williamson 141
The Dakhla–Owenat Road . . . . W. J. Harding King 153
The Tercentenary of Common Logarithms 156
Geophysics in the United States: Review 157
Reviews The Monthly Record Meetings of the Society
Contents v
Society Notices vi

LONDON
THE ROYAL GEOGRAPHICAL SOCIETY
KENSINGTON GORE S.W. 7
EDWARD STANFORD, LTD. 12 LONG ACRE W.C. 2

Price Two Shillings

HENRY SOTHERAN & CO.,

New and Second-Hand BOOKSELLERS

DEALERS in PRINTS and AUTOGRAPHS, and Agents for Public Institutions and Libraries at Home and Abroad.

THEIR SCIENCE DEPARTMENT IS UNRIVALLED IN ENGLAND.

Books needed by Students sought for and found, however unimportant or obscure.

BOOKS and LIBRARIES BOUGHT, or VALUED for INSURANCE or PROBATE.

140, STRAND, W.C.2. (Tel. 1515 Central.) 43, PICCADILLY, W.1. (Tel. 7741 Gerrard.)

Telegraphic and Cable Address:—BOOKMEN, LONDON.

THE GEOGRAPHICAL JOURNAL

Covers for binding volumes of the 'Geographical Journal' can be obtained direct from the Chief Clerk, Royal Geographical Society, at a cost of 3/- per cover, not including postage. Each volume comprises six numbers of the 'Journal.' The cover is of blue cloth, lettered in gilt, similar to that used in the Society's Library.

You are sure to need

BOVRIL

Prevents that Sinking Feeling

The Geographical Journal

Vol. LXV No. 2 February 1925

YUGOSLAV-HUNGARIAN BOUNDARY COMMISSION

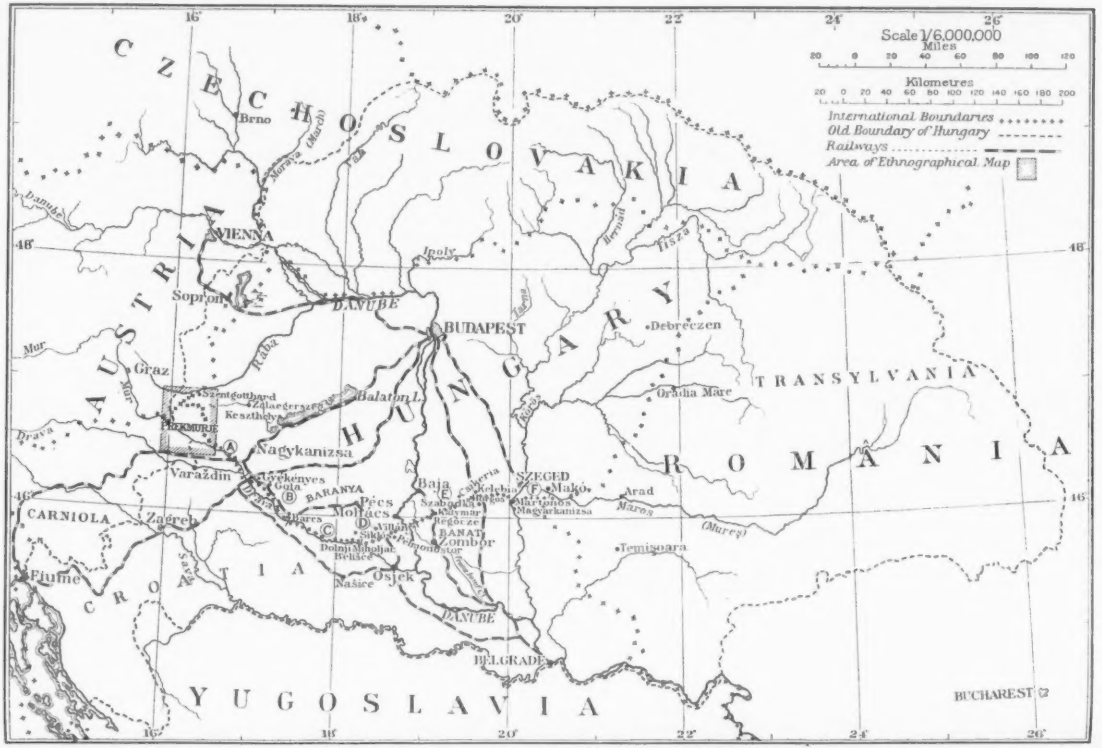
Lieut.-Colonel D. Cree, R.E., British Commissioner

Read at the Meeting of the Society 15 January, 1923, but publication deferred until the conclusion of the Commission's work.

Historical Sketch.

AS a preliminary to a description of the work of the Yugoslav-Hungarian Boundary Commission, it will be useful to have a rough sketch of the history of the two countries, at least as far as their mutual relations are concerned, as some such study is necessary in order to get an insight into the ideas of the two Interested Commissioners. This is all the more desirable, as to obtain good results from the work of the Commission one must do all that is reasonably possible to obtain a general agreement, adopting a sympathetic attitude to both points of view, so that one may influence either side to make concessions. Yugoslavia—or, as it is known officially, the Kingdom of Serbs, Croats, and Slovenes—consists to-day of Serbia, Montenegro, Bosnia, Hercegovina, Dalmatia, Croatia, Slavonia, Carniola, and parts of the comitats of Styria, Baranya, Bács Bodrog, Torontál, Termes, and Zala. These last five comitats were up to 1918 part of the kingdom of Hungary, to which Croatia-Slavonia also belonged, though it enjoyed a certain degree of autonomy. The remainder, with the exception of course of Serbia and Montenegro, were provinces of Austria. Croatia from remote times has been of great political importance, seeing that it bars Hungary's road to the sea, with the natural result that the Magyars have always tried to make it a part of their kingdom.

In 1102 King Coloman of Hungary became King of Croatia, from which time Croatia has always been connected with Austria or Hungary, though her actual status has continually changed. In 1848, the Croats under Jellacić co-operated with the Russians to assist Austria in suppressing the Magyar National movement under Kossuth. After the Austrian defeat by Prussia in 1866, the "Ausgleich" of 1867 between Austria and Hungary, which laid down the relations of the Dual Monarchy, was followed in 1868 by the Nagoda or compromise between Hungary and Croatia, which finally settled the Croatian position until 1918. Under this agreement she had her own Diet at Zagreb, but sent



Sketch-map of the New Boundaries of Hungary.

representatives to the Hungarian Parliament, where alone questions concerning the military, financial, and foreign affairs of the two countries were regulated.

This shows that her autonomy was very restricted; she actually controlled only administration, justice, and education, while the executive authority was in the hands of a Ban or Governor dependent upon the Hungarian Government. In fact, the Magyars claimed that Croatia-Slavonia was a province of Hungary, while the Croats claimed that she formed a separate kingdom united to Hungary by possessing a common sovereign. Magyar and Croat historians have always hotly supported their two points of view, and where the former after a crisis talk of "submission," the latter call it "reconciliation." Slavonia, which lately was united with Croatia, formed originally a separate kingdom. She however came under Hungarian control about the same time. Her position also continually changed, but in 1868 she was included in the Nagoda between Hungary and Croatia as part of the united kingdom of Croatia-Slavonia.

The history of the relations between these states is further complicated by the period of Turkish domination which lasted from the battle of Mohács in 1527 to the final defeat of the Turks by the Polish King Sobieski before Vienna, and their expulsion from Austria and Hungary in 1683. During this period the frontiers were modified and there was a considerable Serbian immigration into southern Hungary.

The part of the boundary which follows the former boundary between Croatia and Hungary, and is formed by the river Dráva for a distance of over 200 kilometres, coincides closely with the ethnical frontier. It is a matter of history that in early days the greater movements in this part of the world followed the valley of the Sava, so that the Dráva is more suited for an international boundary than is generally the case with rivers. However, at the western end of the frontier in the Prekmurje, and for the whole eastern end in the Baranya, Bačka, and Banat, rivers no longer serve. In the Prekmurje there exists a Slav people known as the Wends, a part of the Slovene race who at one time overran the greater part of Austria, from which they were gradually driven back by the Germans from Bavaria. They did, however, leave colonies here and there which have gradually mixed with the German element, and this mixture may account for the distinct difference between the Austrian and the Northern German. These Wends speak a language which to-day differs considerably from the Slovene, and they have in parts been largely Magyarized.

This district of Prekmurje lies in the southern part of the corridor which it was at one time proposed to construct to connect the Yugoslavs with the Czechs and divide Austria from Hungary. In the Baranya, Bačka, and Banat the races are much mixed, owing to wars and the continual ebb and flow of emigration, and the planting here by the Habsburgs of military colonists coming from Germany. Here one finds

also Bunjevats and Sokacz. These are Serbs who came originally from Dalmatia and Bosnia but are Roman Catholics by religion, and the national feeling is undoubtedly less strong among them than amongst the orthodox Serbs.

The Treaty of Trianon and the Covering Letter.

The boundary between Hungary and Yugoslavia, as traced by the Treaty of Trianon, leaves the Austrian frontier about 15 kilometres south-west of Szentgotthárd at a point on the watershed between the Rába and the Mura about 2 kilometres east of the village of Tóka. It follows this watershed roughly due east for about 16 kilometres, and then leaves it to run in a south-easterly direction across country to the Lendva, which it meets about 9 kilometres above its junction with the Mura, and it then follows first the Lendva and then the Mura downstream to the junction of the latter with the Dráva, which it follows downstream to a point about 2 kilometres above the railway bridge at Gyékényes, where it meets the old Hungaro-Croatian frontier, which it follows for over 200 kilometres to a point on the Dráva about 10 kilometres east of the town of Miholjac Dolnji, where it leaves this frontier and the Dráva and runs east-north-east across the Baranya to a point on the Danube about 8 kilometres below Mohács; thence it runs roughly eastwards, passing north of Szabadka to a point on the Tisza about 7 kilometres below Szeged, and then for another 45 kilometres still eastwards to the Roumanian frontier. Its whole length is nearly 650 kilometres.

It will be remembered that the Hungarians protested against the terms of the Treaty, and before they signed they received a covering letter from the Supreme Council at Paris which made certain vague promises of rectifications for the frontier if they should be recommended by the various Boundary Commissions. If, briefly, these Commissions found anywhere that the frontier caused an injustice for ethnical and economical reasons, which it was to the general interest of both countries to remove, they were to forward a report to the Council of Ambassadors at Paris suggesting a new line, with their reasons for an alteration, and the Council of Ambassadors would then examine the report and forward it to the Council of the League of Nations, who were to offer their good offices to the two countries with a view to arriving at a friendly solution. It must be remembered that while Hungary lost about two-thirds of her ancient territory under the Treaty, to the north a new country was brought into being largely at her expense, while to the east and south Roumania and Serbia had been greatly increased also largely at her expense, so that this covering letter might—and in fact did—give rise to large claims from her side. As any alteration that might be proposed would naturally entail a change in the Treaty, the position of the Boundary Commissions was somewhat difficult, especially seeing that all the countries concerned had signed the Treaty of which this letter did not form part. The

ORDINARY BOUNDARY STONE

CROATIAN-HUNGARIAN STONE
RENUMBERED

INITIAL STONE OF A SECTION

COMMON POINT, AUSTRO-HUNGARIAN-YUGOSLAV BOUNDARY

TWO COMMISSIONS AT AUSTRO-HUNGARIAN-YUGOSLAV BOUNDARY POINT

THREE-BOUNDARY POINT SOUTH OF MAKO

Yugoslav attitude, in fact, was that the covering letter was an interesting document, but of no force as far as they were concerned, and they therefore insisted on the strict application of the Treaty.

Preliminary Meetings.

Of the four boundary commissions constituted by the Treaty of Trianon, two were already on the ground. The remaining two—the Roumanian and Yugoslav Commissions—met in Paris on 1 August 1921, where rooms were put at their disposal by the *Service Géographique de l'Armée*. Here all preliminary details were settled. At the first meeting the President was elected and the organization of the Commission was then settled. This is generally about the same in all commissions, the French, Italian, and English Delegations consisting of a Commissioner and two N.C.O.s as clerks. It is laid down that one should be a topographer, but only in the English Delegation had any one any technical knowledge. The Japanese Commissioner had a Japanese secretary and a French interpreter. The interested Commissioners were at liberty to organize their delegations to suit the varying problems that might arise. Further, a Secretariat was appointed to the Commission, this consisting of a French captain as secretary and a clerk, also French.

It was also decided that the necessary transport should be provided by the country in which the Commission should be at the moment. This arrangement undoubtedly makes for economy and prevents accusations of joy-riding being made against the Commissioners, as the countries concerned always control the cars. It also simplifies the accounts of the various delegations; but at the beginning it was not too satisfactory in this case, as it was some time before suitable cars were provided by the Yugoslav Commissioner, and even to the end the tyres left very much to be desired.

It was further decided to work from west to east, and that as the work progressed the Commission should move its headquarters along the frontier, making them alternately in Yugoslavia and Hungary. This again simplified financial questions as between the two countries, as it was decided that each should settle all charges for quarters and transport while the Commission was on their side of the frontier.

Varaždin in Croatia was selected as the first headquarters. The frontier was then divided into six convenient sections: the first from the Austrian frontier to the junction of the Lendva and Mura, the second from this point to the railway bridge over the Dráva at Barcs, the third from this bridge to the point where the frontier leaves the Dráva, the fourth between the Dráva and Danube, the fifth between the Danube and Tisza, and the sixth from the Tisza to the Roumanian frontier.

The only question then remaining was the transport of the Commission to the ground. This was arranged for, and a date for departure fixed, and the Commission adjourned to allow each delegation to make its

own final arrangements and the Yugoslavs to prepare headquarters and transport at Varaždin. During this period in Paris, the Presidents of the four Hungarian Commissions had a meeting with the head of the *Service Géographique* to discuss the bearing of the covering letter and to interchange ideas, and at the third meeting of the Commission the Interested Commissioners were warned that any propositions they might make under this letter must be limited in extent, or in demanding too much they would risk getting nothing.

On 11 August 1921 the Commission left Paris, arrived at Zagreb, the capital of Croatia, on the 13th, and went by car to Varaždin on the 15th. This is a small town situated on the Dráva, about 75 kilometres north of Zagreb by a good road. The Commission then paid official visits to Belgrade and Budapest, and returned to Varaždin on the 23rd to start work.

Maps.

It had been decided in Paris that the Interested Commissioners should at once commence a reconnaissance in Section A, so that by the time the Commission was ready to start work in Varaždin they could submit their proposals for the first part of the frontier. However on our arrival we found little had been done, and what was even more serious, there were no maps available. The question of the maps had already been raised in Paris, and it had been pointed out to the two Interested Commissioners that they were responsible for supplying all the maps and documents required by the Commission. They had replied that it might be difficult, as all the maps of the country were still produced by the *Militargeographisches Institut* at Vienna. They promised however to do all they could. As this was not my first experience of boundary commissions and promises, I had not much faith in the results of their efforts even if made, so on my return to London I told the Geographical Section, General Staff, at the War Office of the difficulty, and they wired to our military mission in Vienna to ask them to do what they could, telling them to get in touch with me in Yugoslavia. Unfortunately the wires from Vienna never reached me, so that I imagined nothing had been done there. I therefore wired to the Council of Ambassadors at Paris, and so got in touch with the Allied Mission in Vienna. As a result I went to Vienna myself, and found that our Mission had already asked the Institute to get the frontier maps ready for me. This saved a lot of time, and I was able to leave two days later with all the maps necessary to start the work and a promise that the remainder would be ready whenever I could come to collect them. The maps we used were the 1/200,000 for travelling and a general study, and the 1/75,000 for work. On maps of this scale all propositions were made. Both these maps are well reproduced and fairly up to date. We had also 1/25,000 maps. This is the scale on which the original survey of the Empire was made, the other scales being reduced

from it. It was however made about 1850, and has not been kept up to date, the revisions being carried out on the 1/75,000 maps, while it is very badly reproduced. We also had the use of the cadastrals. These are generally drawn on a scale of 1/2880 and are also very out of date, most of them in the frontier district not having been touched since 1859. In addition, we had access to special property plans, river surveys, etc. All these latter were, of course, available locally.

Method of Work.

In settling the method of work to be adopted, we had always to bear in mind the effect of the covering letter and the complementary instructions issued therewith. As the first necessity in this part of the world, and indeed of Europe generally, is to have the boundary definitely fixed, so as to put an end to the uncertainty and agitation which are disturbing the frontier villages, it seemed desirable to adopt a method which would enable the work to be carried out as quickly as possible and still conform with our instructions. Now these instructions laid down that Commissioners were to begin by a general study of the frontier in order to determine where the Treaty must be strictly applied and in which districts an appeal might be made to the League of Nations. Further, that where no appeal was to be made, the frontier should be fixed at once, following the original instructions. Again, if any appeals were to be made, all possible modifications were to be considered together for the whole frontier before any report was forwarded, in order to try and find a means of arriving at a possible agreement between the two countries.

It will be noticed that, strictly followed, these instructions would result in a rather complicated procedure. Moreover, it must be remembered that a line of demarcation which more or less followed the line laid down in the Treaty already existed. If then we were first to lay down a line temporarily, strictly following the Treaty, and later a third line which was to be the final frontier, and in addition possibly a fourth which was to be the subject of an appeal to the League of Nations, the state of doubt and uncertainty in the minds of the peasants living on the frontier can be better imagined than described.

To avoid this we decided to adopt the following method: We resolved to fix definitely at once the frontier as laid down in the Treaty, working in accordance with the original instructions to Boundary Commissions, but before we started our inquiries on the ground we demanded from the Interested Commissioners, not only their propositions for the Treaty Line itself, but also any propositions that might be the subject of an appeal to the League of Nations. In this manner we were able, during our inquiries on the Treaty Line, to keep the other question also in our minds, so by the time we had decided on the line the frontier should follow under the Treaty, we had already a great deal of valuable information for the further proposition. In fact, in all cases except one, at the

end of our first inquiries we decided by five votes to one that no sufficient case could be made out for an appeal to the League of Nations. In the remaining case we were as a result of our first inquiries enabled to cut down the Hungarian proposition to about a fifth of its original dimensions, and so greatly limit the extent of our subsequent inquiries. Acting on this plan the work was carried out as follows :

When the preliminary reconnaissance is completed the Interested Commissioners prepare and submit their proposals for the frontier. These proposals deal with the ethnical and economical conditions of the portion of the frontier under consideration, and are supported by maps and frequently by special pleas from chambers of commerce, large property owners, factory owners, and so forth. A meeting is then held at which they are discussed, and any further information that may be required by a commissioner may be obtained. This ensures that before going on the ground, every one has a good knowledge of local conditions, and in addition the rival propositions control each other, as each is a very biassed statement of the case.

Inquiries on the Ground.

At these meetings a programme was drawn up for the inquiries on the ground, the idea being that delegations from all communes that touched the frontier should be heard and that a meeting in Hungary in the morning should be balanced by one in Yugoslavia in the afternoon. The local authorities were warned a week in advance of the date of the meetings, and the communes had then to elect their delegations on which all minorities, however small, had to be represented. These delegations were headed by the mayor and consisted of six delegates. It has been objected that boundary commissions never really get at the truth, as all evidence presented to them is carefully prepared by the interested authorities. That is true, and it is difficult to see how it can be avoided, but at the same time by this method we had evidence from either side of the same portion of the frontier on the same day, so that the statements on one side could be controlled by those on the other. In addition, though we employed a questionnaire we could put any questions we liked in order to check the answers, and we had also with us the latest official statistics which were prepared in 1910. These were of course of Hungarian origin, and probably not over-favourable to the Yugoslavs. Still they were prepared four years before the war, so could not be suspected of being produced for the purpose of influencing a boundary commission.

These meetings were held at convenient centres for the local inhabitants, so that generally from four to six delegations were heard at each meeting. Sometimes the meeting-place would be on the main road, when there was no difficulty about getting there, but more often it was not, and in a country where main roads are few and far between, and

even they can only be described as poor, it can be imagined that some of our journeys by road were distinctly lengthy affairs and decidedly interesting, as we went in the first section almost everywhere by car, and the native drivers have not the respect for their springs that we have in England. Even so we were sometimes forced to leave our cars and get to our destinations in horse-drawn carriages.

As an example of the roughness of even the main roads, I may tell the story of the Hungarian courier, who was sent by his chief across the frontier to pick up the train in Hungary. The chauffeur drove with his usual speed and apathy, and on arriving at the station turned round to speak to the sergeant-major, who should have been with his papers on the rear seat, but he was no longer there. He had been thrown out at a bump. This was certainly unusual, but it is no uncommon occurrence to lose light articles out of cars in this manner.

The principal questions at these meetings were always put by the President, and when he had finished, the other commissioners put questions to elucidate any points about which they were in doubt, or an Interested Commissioner might try to get evidence to emphasize any special point he had made in his proposal. When the inquiries on the ground were finished in any section, further meetings would be held to discuss the propositions in the light of the knowledge gained on the ground, and attempts would be made generally by the others to get the two Interested Commissioners to come to an agreement.

In the mean time the President would have private meetings with them, either singly or together, with the same object. At first this had good results, as up to Christmas, by which time the first three sections were finished, we were able to get an unanimous vote on all occasions on which the frontier was definitely fixed. When an agreement seemed to be reached, or when it seemed that no advantage was to be gained by further discussion, a meeting was held to fix the frontier definitely. In this meeting I would start by describing in detail the line I proposed, and would then ask the other commissioners in alphabetical order to give their ideas. If any proposed line differed from the first, the differences would be discussed, to try and come to an agreement. If none were possible, the lines would be voted on in succession until one received a majority. Sometimes, if a general agreement was reached except in some particular portion, this part would be left out, the remainder being fixed definitely, and we would then adjourn for further consideration of this portion, assisted if necessary by a visit to the ground itself.

Once the frontier was thus definitely settled, it was drawn in red ink on a 1/75,000 map, which was then signed by the Commissioners, and, accompanied by a description of the frontier, became the official record, and will so continue until such times as the final maps of the frontier are made and signed. On one or two occasions there were special protocols drawn up to settle minor details in the working of the frontier. Such

cases arose in connection with the railway station at Gola and the water supply for the station at Gyékényes. It has been laid down by the Council of Ambassadors that it is not the duty of boundary commissions to draw up these protocols unless asked by one or other of the Interested Commissioners, and in any case they must be accepted by the two governments. In these two cases we had succeeded in getting unanimity in the Commission for the whole section except for these two points, for which special treatment was demanded by the Interested Commissioners. For this purpose these protocols were drawn up by the Commission and subsequently accepted by the two governments.

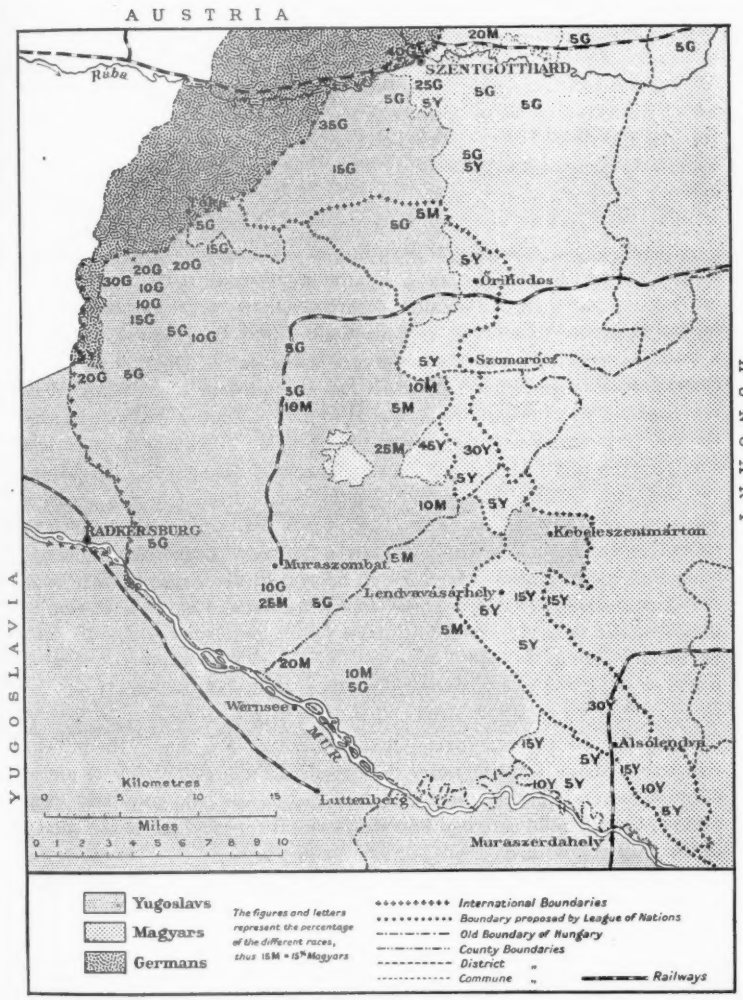
When the frontier has been definitely settled, it is at once marked out with pickets by the assistant commissioners of the interested countries, and while carrying this out it was their duty to note and report any point in which they were not in agreement, owing to inaccuracies on the maps or changes of commune boundaries or the like. In addition notice is given to the two governments, that they may occupy the line in fifteen days.

The Frontier by Sections.

Section A.—When the Commission arrived on the ground neither the Yugoslavs nor the Magyars occupied the frontier laid down by the Treaty of Trianon. The former were still in possession of the Baranya with the coal district of Pécs, while the latter had not yet evacuated the Western Comitats of the Burgenland. It was decided by the Supreme Council in Paris that the Yugoslavs should carry out their evacuation first, and when it was completed the Hungarians were to follow suit. The evacuation of the Baranya was duly carried out, but when it came to the Hungarians' turn they did not fulfil their obligations. This had been foreseen by the Yugoslavs, and they had protested against having to carry out their evacuation first. As a matter of fact the Hungarians still occupy an important part of this district, and the dangerous work of revising treaties was commenced by the Venice agreement, which left the Hungarians in possession of the Sopron district as a result of the plebiscite which it arranged.

Our first section, A, was in some ways the most interesting, as it is the frontier line of the district known as the Prekmurje, and it was a part of this district which became the subject of our appeal to the League of Nations. In addition the northern part marches with the Burgenland, then wrongfully in Hungarian occupation. It was indeed suggested that we should wait to begin our work until the evacuation was carried out, but it seemed preferable that we should carry on at least till some one tried to stop us. This never occurred, and as far as we saw the utmost tranquillity reigned in the southern portion of the Burgenland.

We were, however, unable to arrange a meeting with the Austro-Hungarian Commission to fix the point common to Austria, Hungary,



Ethnographical Map of the Prekmurje Area and the Boundary demarcated by the Commission.

and Yugoslavia. This was disappointing, and in the end we were unable definitely to fix this point until the following May, when our headquarters were at Szeged, at the opposite end of the frontier, some 600 kilometres away. We however visited the point and fixed it provisionally.

The Prekmurje is roughly in the form of a triangle, bounded on the west by Austria, on the south by the Mura, and on the north and east by the line laid down in the Treaty. This line follows the hills forming the watershed between the Mura and Rába for 16 kilometres and then an arbitrary line running across country in a south-easterly direction till it meets the Lendva, which it follows to its junction with the Mura. The whole of the district was demanded by Hungary. The population is predominantly of Slav race, known as Wends, a Slovene family, although to-day there are material differences between the two languages. It was therefore difficult to support their claims on ethnical grounds; a good economical case was however made out. Only one line of railway serves the district, and this has its terminus at Muraszombat, the chief town, whence it runs into Hungary. Another railway crosses the extreme south-eastern corner of the triangle. This is a through line from Zagreb and Cakovacs to Zalaegerszeg and Hungary. The Mura, the southern boundary, is a river of some importance which forms a considerable obstacle. It is liable to floods and continual changes of course, and in the winter may be blocked with ice. In the 60 kilometres from the Austrian boundary to its junction with the Lendva, there were only two bridges in existence while our inquiries on the ground were in progress, and these were together about 15 kilometres above the junction, so that for some 40 odd kilometres there were no bridges. A bridge however was under construction at Wernsee, about halfway from the existing bridges to the frontier. This bridge is a wooden pile bridge, and was opened in April 1922. Of the other two, one carries the railway referred to above, and the other the main road alongside. There are in addition several ferries, most of which take farm waggons and even motors, but the roads are bad and the ferries themselves are at the mercy of the river conditions.

As a natural result of the lack of communication towards the south, the trade of the district turned towards Hungary, and in the south-west towards Radkersberg in Austria. The first two days of our inquiries on the ground to determine the frontier line according to the Treaty, were marked by pro-Hungarian demonstrations by a large number of people on the Yugoslav side of the frontier. The demonstrators were kept under control by the military and police, and several arrests were made. It was noteworthy that there was no counter demonstrations, but it is at least possible that these demonstrations were in part organized from the other side of the frontier. Somewhat severe measures were taken by the Yugoslav authorities to prevent further disturbances whilst we were

PLATE ON MIHOLJAC DOLNJI BRIDGE

NEW BRIDGE ACROSS MURA, WERNSEE

LOCAL DEMONSTRATION AT MAGASFOK

MINEHEAD AT PÉCS

COMMISSION'S VOLUNTEER ESCORT, BARANYA

LOCAL DELEGATION AT NEMESNEP

in the neighbourhood, and these measures were the subject of a complaint made by the Hungarian Government. At a subsequent inquiry into the charges made in this complaint, it was established that they were greatly exaggerated and that the measures, though severe, were justified by the necessity of maintaining order in a newly acquired frontier district.

After the Treaty Line leaves the Rába–Mura watershed and turns to the south-east, it cuts off from Hungary a band of purely Magyar villages which lie all along the frontier as far as the Mura. The inhabitants of these villages had for generations been accustomed to go down to the Hungarian plains as labourers at harvest-time and they received their pay largely in kind. It may be mentioned that the soil of the Prekmurje itself is poor and does not produce enough for the inhabitants. The wheat thus earned they brought back with them on their return, and lately it had been transported in trucks along the Muraszombat railway. Since the war, however, and the occupation of the country by the Yugoslavs, customs difficulties had arisen at the frontier, so that the peasants suffered a great loss. In addition there are many members of the Reformed Churches in this district who are now cut off from their church. Taking all these facts into consideration, it must be admitted that the position of these villages was the reverse of happy. During our inquiries we discovered almost by accident that a railway was projected, and that in fact work had already been started on it, to connect Muraszombat with Luttenberg and Ormuz. This railway would naturally make a great difference to the economic conditions of the district. It is now approaching completion, a ferro-concrete bridge carrying it across the Mura.

As a result of our inquiries, it became evident to all the non-Interested Commissioners that the Hungarian demand for the whole triangle was inadmissable. It attacked the bases of the Treaty; it could not be supported on ethnical grounds; and in addition the economic condition of the greater part was not so desperate as had been stated. We were however of the opinion that a better line ethnically and economically could be found, and that it would be to the advantage of both sides to accept such a line in preference to that laid down in the Treaty. It must be remembered that wherever new frontiers are drawn some inconveniences and even hardships must arise as a result, but that if time be given for conditions to become settled, local trade and conditions will adjust themselves to their new orbits and these hardships tend sooner or later to disappear. In addition, once a treaty has been signed and ratified, the alteration of any of its clauses is not a question to be lightly undertaken; therefore we wanted to make as sure as possible of our ground before forwarding any proposition.

With this object in view we carried out further inquiries. These consisted in hearing delegations from Muraszombat and five other centres in the eastern half of the district. From these inquiries it became

evident that in the north and north-east of the district the boundary of the arrondissement of Muraszombat corresponded very closely with the economic boundary. South of this line the villages looked to Muraszombat or other local centres. North of it they were still attached to Szentgotthárd, and this applies even to the six Wend communes of the Szentgotthárd county, which the Treaty had attributed to Yugoslavia. In the east there is the band of twenty-five Magyar villages already referred to, which were undoubtedly very strongly attached to Hungary. Among these villages is also the Wend commune of Kebeleszentmárton, whose delegates had also spoken of its attachment to Hungary. In the south five of these villages and the southern part of the commune of Alsólendva are cut off by the Lendva stream. This stream has been canalized and provides a distinct natural line. Moreover, in any proposal we might make it was necessary to leave the two bridges at Muraszerdahely and the road to Muraszombat in Yugoslav hands, or for the time being the whole district would have been entirely isolated.

Having fully considered all these questions, we decided to recommend that the six Wend communes of the Szentgotthárd and the twenty Magyar villages north of the Lendva, including the Wend village of Kebeleszentmárton should be returned to Hungary. As an additional reason we pointed out that it could not be to the advantage of Yugoslavia to have this homogeneous hostile population on its frontier. Having prepared our report, a short study of the rest of the frontier made it clear that in no other section was it probable that we should have any proposition to forward to the League of Nations, there being in every case good reasons, either ethnical, economical, or military, against any change of the Treaty Line. We therefore decided to forward our report at once in the hope that it would be dealt with in the next meeting of the League of Nations, so that the question might be settled definitely as soon as possible.

In this we were disappointed. The matter has however been since fully examined by the Council of the League, who were unable to persuade the two interested countries to come to a friendly settlement, and in consequence reported that nothing could be done, so that the line we traced under the Treaty now stands as the definite frontier. The report and appeal to the League of Nations were completed and forwarded to the Council of Ambassadors on November 15. Our inquiries had finished on October 18, and the Interested Commissioners had asked for an interval to make their reconnaissance in sections B and C and to catch up arrears in their work. Consequently the Commission adjourned from October 20 to November 7, when we commenced work on section B. It may be remembered that the ex-Emperor Karl's second unsuccessful attempt to regain the Hungarian throne started on October 22, and though this lasted only two or three days, the frontiers were still closed on November 7. We however pointed out that such closing could not

apply to boundary commissions, and we were able to carry out our programme.

Sections B and C.—On November 10 our headquarters were moved to Nagykanizsa, in Hungary. Winter had already commenced, and the weather was very cold and there was a great deal of snow. We had already determined to shut down the Commission for two months during the winter, but we wished to complete at least our inquiries on sections B and C before doing so. Fortunately, from Nagykanizsa railway communication is fairly reasonable on both sides of the frontier, and a special train was put at our disposal. By this means, in spite of an unusually hard and early winter, we were able to finish our inquiries in time to adjourn on December 16. The frontier in sections B and C follows the Mura downstream to its junction with the Dráva, and then the latter river downstream to near the Gyékényes railway bridge, where the river meets the former Hungarian–Croatian boundary. From this point the line laid down in the Treaty follows this frontier to a point 10 kilometres below Miholuac Dolnji, where it finally leaves the Dráve to cut across the Baranya.

There was no great divergence of opinion about these two sections between the two interested delegates, neither side making any appeal to the League. The question was however not entirely simple. The Hungarian–Croatian boundary in this district originally followed the Dráva. This river is navigable by steamers as far as Barcs, up to which point it has now been regularized for most of its length. Steamers have indeed gone further upstream, but this is not a regular practice, and above this point little has been done to regularize the course, which has always been, and in some parts still is, subject to considerable changes of channel, with the result that it now follows a very different line from that of the boundary, which did not change with the river. For some time previous to the War a commission had been at work definitely marking out this boundary; its work was completed in the early part of 1914, and the very useful maps which it had made were at our disposal.

Following as it does the old course of the river, the line generally coincides with dead arms, so that there are considerable enclaves on either bank cut off from the rest of the country by the present course. These enclaves naturally became a more serious problem when Croatia became part of an independent country, instead of a more or less autonomous province of Hungary. But in any case the liability to changes of channel would render it undesirable as an international frontier. On the other hand there was the plea that the existing line was really an international and not a provincial frontier, and so could not be altered by the Commission.

Finally, a general agreement was reached by which the old line was followed above Barcs and the present regularized course of the river below. In the former section there were two questions which required

special protocols. The first was the railway station at Gola, a large commune including three villages on the left bank of the Drava, enclosed between the river and the frontier, which leaves the river above the Gyékényes bridge and makes a Yugoslav enclave on the north bank of about 26 kilometres long by 5 wide. The old boundary actually cut the Gyékényes–Barcs railway here in some half a dozen places, but the Treaty stipulated that this railway should remain entirely in Hungary, the inhabitants of Gola being given certain rights to the use of the railway station of Gola. Yugoslavia, possessing the bridge at Gyékényes, proposed to build a new station in this enclave connected to the bridge by a short length of line. To enable this to be done some slight modification was made, and the rights of the inhabitants of Gola in the present station were restricted to a definite period.

The second question was the pumping plant of the station at Gyékényes. This plant was close to the bridge, and was therefore cut off from the station by the boundary. The station is of some importance, as it is the frontier station on the direct line from Zagreb to Budapest. A protocol gives the Hungarians the control of this plant and right of access when necessary. The railway lines in this district running along the frontier, though of normal gauge, are very second rate, the permanent way being poor. As an example, it takes six hours for an ordinary train to cover the distance of 60 kilometres from Siklós to Barcs. In consequence it was not possible for us, even with our special train, to return daily to our headquarters at Nagykanizsa, so two nights were spent at a chateau near Barcs, and two at the big tanning and wood works at Belišće, at both of which places we were very hospitably entertained. The cold weather continued the whole time, and snow fell at intervals. The Commission adjourned for the winter on December 16, and reassembled at Osjek in Yugoslavia on February 20, to find a temperature of 15° below zero Centigrade, deep snow, and the Dráva frozen solid.

Section D.—Our next section, D, comprised that part of the boundary between the Dráva and the Danube where the frontier crosses the comitat of Baranya, running in a north-easterly direction from east of Miholjac Dolnji to south of Mohács. Here it was much more difficult to come to a decision, and both sides put in propositions for an appeal to the League of Nations. It was at once possible for military reasons to restrict the extent of these propositions. The Baranya is for the most part flat and low-lying, but to the north of the Treaty Line there is a range of hills running from west to east and rising to a height of 442 metres, which terminated at Villány, a well-known centre for Hungarian wine. To the south there is a range running east from Pélmonostor to the Danube, which rises to a height of 243 metres. From the former, Pécs, an important Hungarian town with its coal-mines, could be commanded by artillery; from the latter, Osjek, an important Yugoslav centre, is equally exposed. It was therefore impossible to let either of

these ranges pass into the hands of the other country. The population is very mixed, with a large proportion of Germans, descendants of the military colonists placed there by Maria Theresa and her successors, and it was therefore not possible to make out a good ethnical case for any change of the Treaty Line.

Economically neither side is badly situated, good markets are available, the country is productive but low-lying and bounded by two great rivers. In consequence special measures have been taken to drain it, and the whole area has been divided into several drainage basins across which the Treaty Line cuts. It would be quite impossible to avoid cutting across these areas, unless the frontier was removed south to the Dráve or considerably to the north. This was obviously impossible, so that we contented ourselves by tracing a line which closely followed the one laid down in the Treaty, but did not cut up communes, and interfered as little as possible with the drainage schemes. The fear of intentional obstruction to these schemes were certainly exaggerated, and it must be remembered that the feeling of suspicion and unrest which exists on both sides of the frontier is undoubtedly decreasing, and one hopes that it will ultimately disappear.

Section E.—Our next section was that part of the frontier between the Danube and the Tisza. Here again the line laid down in the Treaty follows no natural features, but tries to find the ethnical boundary across the south-eastern corner of the great Hungarian plain. In addition the line is apparently controlled by the desire to leave the Franz Josef Canal, which links the Danube and the Tisza, the railway junctions of Regöcze and Horgos, and the town of Szabadka in Yugoslavia. The Treaty does indeed lay down that the boundary should follow the Kigyós for some distance, but unfortunately, like so many others in this district, this stream has no fixed course, and is rather a succession of swamps; and in addition it cuts right across two communes, those of Katymar and Bácsmadaras, and even cuts off the south-west corner of the former village itself. It is therefore unsuitable for a boundary.

Elsewhere in this section the line was drawn arbitrarily across country. Here again there is a very mixed population, and hardly in any commune could either side claim an absolute majority of inhabitants, owing to the large number of German colonists planted there at different periods by the Habsburgs. The single exception to this condition is provided by the communes of Horgos, Martonos, and Magyarkanizsa on the right bank of the Tisza. Here out of a population of 31,000 over 29,000 are Magyar. In Horgos itself there is a purely Magyar population of 8000, but the Treaty laid down that this railway junction was to remain in Yugoslavia, so that without an agreement between the two Interested Commissioners it was impossible to effect a change.

The country in the whole of this section is flat and liable to floods and with practically no distinctive features. We therefore followed as

far as possible the commune boundaries, and where communes were cut, the limits of properties. There is in this section, however, the town of Szabadka. This is now one of the largest towns in Yugoslavia as well as an important railway junction. It is the frontier station on the Yugoslav side on the direct line from Belgrade to Budapest. Szabadka was made a free town by Maria Theresa in 1779, and with it was included a large tract of territory extending some 17 kilometres to the north of the town. Now the line traced by the Treaty passes only 7 kilometres to the north of the town, so that it has lost a large part of its territory, the greater part of which belongs to the municipality. Along the frontier the land is poor, dry, and sandy in summer, but liable to floods in winter, and for the most part it is pasture. There are also a few fields of rye, some acacia plantations, and some small vineyards. As there were here few limits we could follow, we traced the boundary across this territory in a series of straight lines passing through the points mentioned in the Treaty, which left the railway stations of Kelebia and Csikeria in Hungary, but gave Szabadka as much of its property as possible.

To the east of the main railway line runs the stream Körös. This was until recently a succession of swamps similar to the Kigyós, but it has lately been canalized to facilitate the drainage of the county to the north. It is therefore now of great importance to this Hungarian district, so that when the line reached this stream, it was taken as the boundary; but we left the whole stream in Hungary, as she was more interested in the maintenance of the present canal. Shortly after it becomes the boundary, this canalizing ceases, and the Körös is here a distinct rivulet of some 2 to 3 metres wide, which forms also the boundary of Szabadka, and 10 kilometres lower it passes into Yugoslavia, as the boundary turns east to follow the northern limit of Horgos. For a long time I had hopes that an agreement might be made to effect exchanges in this section, which would have considerably improved the frontier, but though the negotiations continued from February to May they finally failed, to the great disappointment of all the non-Interested Commissioners, as it was impossible for us to do anything on a majority vote, any change of localities mentioned in the Treaty having to be made by the unanimous vote of the Commission.

Section F.—During its inquiries in section E about the beginning of April the Commission changed its headquarters from Osjek to Szeged in Hungary. This is now the second town in the country, and stands on the right bank of the Tisza. Its situation is very low and it is always in danger of being inundated by the river. In the year 1879 a great part of the town was destroyed by flood; in consequence the great dykes which protect it were raised and strengthened, and a canal was cut to straighten the course of the river below the town, to enable the water to get away more quickly. Szeged is close to the frontier, which in fact

follows the municipal boundary, and is also less than 40 kilometres from the Roumanian frontier, so that our last section was a short one.

In this section of the frontier the population is even more mixed than in the others, as considerable numbers of Roumanians are found in the villages. Here again both sides put in propositions for appeals to the League of Nations, but neither could be supported on ethnical grounds. South of the frontier the population is in majority Slav, while north the reverse is the case. Economically, the town of Szeged is the ruling factor. The boundary has cut off from it a great part of the district from which it was accustomed to draw its supplies, with the result that the feeding of Szeged has become a somewhat serious problem, and living is more expensive there than elsewhere in Hungary. The great city of Budapest is only 160 kilometres away to the north, so it is difficult to draw supplies from that direction. To the south there is the Yugoslav frontier on the outskirts of the town, and to the east the Roumanian, hardly 40 kilometres away. In addition, the soil of the district north of the boundary is poor and sandy, while hardly has one crossed the frontier going south than one finds oneself in one of the richest agricultural districts of the former Hungarian kingdom, or indeed of Europe. Szeged's situation would have been greatly improved if we could have allotted Horgos to Hungary, for it is a commune where the land is fertile and the dairy produce is considerable. This possibility disappeared however with the failure of the exchange negotiations, to which I have already referred. We were therefore, to our regret, forced to trace a line following the commune boundaries closely corresponding to the line laid down in the Treaty. We had however to modify the boundary in places, as here the communes are almost inextricably mixed up, and had we strictly followed their limits, an important road would have been so cut as to be useless to both sides.

Common Points.

The fixing of the boundary in this section ended our work on the ground, with the exception of settling the point at the western end, where the frontier leaves Austria and the point at the eastern end common to Roumania, Hungary, and Yugoslavia. The first was soon settled. We definitely fixed the line in Section F on May 4, and the next day left for Graz *viâ* Budapest to meet the Austro-Hungarian and Austro-Yugoslav Commissions. We had already visited the spot in the previous September and fixed a point provisionally. In the mean time, however, a considerable part of the forest in which the point lies had been cut down, and there was no doubt that the point some 200 metres east, selected by the other Commissioners, was preferable to ours ; this point was accordingly definitely chosen.

It closely corresponds with the point mentioned in the Treaty, rather over 2 kilometres east of the village of Tóka on a well-marked hill 300 metres high, on the watershed between the Rába and the Mura.

Unfortunately we had to wait some time to fix the eastern end, as the Roumanian Commission were not ready; and the wedding of the King of Serbia caused a further postponement, as the Yugoslav and Roumanian Commissioners had to be in attendance. It was, however, finally settled on June 20. Here it was quite impossible to choose any prominent point, as in this angle of the Maros and Tisza none exist, the third-order trigonometrical points being on tiny hillocks smaller than an African anthill. We accordingly selected a point which is as nearly as possible that described in the Treaty, some 10 kilometres south-west of Makó, on the eastern boundary of the commune of Obeb. Later a difficulty arose as to this point, as during the negotiations between Roumania and Yugoslavia concerning their frontier, the latter agreed to cede the commune of Obeb to Roumania, thus changing the position of the common point to the west side of the commune. When however the proposed frontier was referred to the Conference of Ambassadors, they decided that this point could not be changed unless Hungary agreed, and Roumania and Yugoslavia were informed that Obeb must remain Yugoslavian until such agreement was received. As has become somewhat common lately these instructions were ignored, and Obeb was occupied by the Roumanians on 1 April 1924. This delayed our work, as when we went to finish the survey of this part of the line we found Roumanian sentries there with instructions to prevent any work being carried out. After some discussions we finally finished the survey, but were unable to set up the monument at the end.

Technical Work.

When this had been done the other three non-Interested Commissioners left for their respective countries, and I remained to superintend the technical work of making an accurate map of the frontier. This work had actually started in the preceding April, but progress was slow. The principle adopted for the work was a traverse of the whole frontier from end to end, well tied in to the existing trig. points, the two common points being treated as trigonometrical points. It had been hoped that no triangulation would be necessary, but in sections A and B it was soon found impossible to identify many of the third and fourth order points required, so that a subsidiary triangulation was necessary, while in that part of the Baranya covered by section D no fourth-order triangulation has yet been made. The distances between boundary stones was limited to 300 metres, with the proviso that from every stone the next stone on either side should be visible.

The boundary stones were of three kinds, the ordinary ones used in sections A, B, C, D, E, and F being of reinforced concrete 1·6 metres long and 30 cm. square in cross-section; they were placed in the ground so that about 50 cm. remained above the surface. The stone at the beginning of each section was rather larger, while in section

B where the frontier follows the old Hungary–Croatia boundary the old stones were used, which are somewhat smaller. All these stones bore the letter of the section and were numbered in series; they also had M.O. (Magyarország) on the one side and C.X.C. S.H.S. (Srba, Hrvata, Slovenaca) on the other. The minor bends of the line were marked by a picket fixed in a mound. The point common to Austria, Hungary, and Yugoslavia is marked by a special monument, while a similar monument has been prepared for the Roumanian end, but owing to the difficulty above referred to, it is still in the stonemason's yard at Szeged.

The actual work presents no difficulties except that in section A, the Prekmurje, the line runs for a great part through forest and at the same time over hilly country with very steep slopes, so that the traverse legs are necessarily short. Rather more points were fixed trigonometrically in this section to provide the necessary control. Another interesting section is that where a river forms the boundary; it was decided to adopt the centre of the principal channel as it now is, and that that should remain the boundary even if the course changes. Here therefore we have surveyed and placed boundary stones on both banks.

The maps and plans of the frontier consist of large-scale plans giving details of all distances chained and angles measured, the scale varying from 1/1000 to 1/5000 according to the amount of detail to be shown. With these are copies of the cadastrals brought up to date, showing the boundary and the stones on the ground for a distance of abut 500 metres on either side. The scale of these cadastrals also vary, but are generally 1/2880. Finally the frontier and stones are shown on a section of the 1/25,000 map, so that the position of the stones may be more easily located. The copies of these maps for the whole frontier have been sent to Paris with the final report of the Commission, and after examination by the Council of Ambassadors one copy will be sent to each of the Interested Powers.

Conclusion.

In conclusion I may say that better relations are slowly being established between the two countries, and the tendency to regard the boundary as a Chinese wall is already past. Agreements have been made to facilitate the cultivation and exploitation of property belonging to people living on the other side of the frontier, and it is not too much to hope that the mutual respect that exists for each other's fighting qualities may lead to the establishment of a friendship between them. It is also pleasant to be able to record that the relations between myself and all the Commissioners were such that the work was carried out in the most friendly way possible, which naturally led to a considerable increase in speed, as we were not hindered by those internal troubles which sometimes obstruct the progress of international commissions.

Note on names: Until the work of the Commission was completed the names in use were ordinarily those of the Magyar maps: on the completion of the demarcation the names of villages transferred to Yugoslavia are changed into the Serb spelling or sometimes altered. The names in the first column below (as used in this paper and the sketch-maps) should now be changed to the equivalents in the second column:

Alsólendva	becomes	Dolnja Lendava	Muraszombat	becomes	Murska Sobota
Kebeleszentmárton	,,	Kobilje	Örihodos	,,	Hodoš
Lendvavásárhely	,,	Dobrovnik	Pélmonostor	,,	Beli Manastir
Luttenberg	,,	Ljutomer	Regöcze	,,	Rigjica
Magyarkanizsa	,,	Turska Kanjiža	Szabadka	,,	Subotica
			Tóka	,,	Tauka
Martonos	,,	Martonoš	Wernsee	,,	Vercej
Muraszerdahely	,,	Središčak	Zombor	,,	Sombor

Before the paper the PRESIDENT (the EARL OF RONALDSHAY) said: This evening we are to have an account from Colonel Cree of the work of one of the various Commissions which were charged with the responsible and often delicate duty of carrying out those readjustments of the geography of the world which were decided upon by the signatories to the Treaty of Trianon. No one, I should imagine, could speak with greater authority upon the particular boundary about which we are to hear to-night than Colonel Cree; the boundary, that is to say, between Hungary and Yugo-Slavia. His authority is great, in part because he is the President of the Commission which has been delimitating that boundary, and also because of his past experience in the delimiting of boundaries. So far as I can make out, for the last three or four years Colonel Cree has been constantly engaged in making new boundaries. He was, for example, a member of the Commission which marked the new boundary of Danzig and that between Germany and Poland. And now he has been engaged, and he still is engaged, upon the boundary between Hungary and Yugo-Slavia. We may look forward, therefore, not merely to an interesting but to a highly authoritative account of the work which he has been directing, and I have pleasure in calling upon him to give us his paper.

Colonel Cree then read the paper printed above, and a discussion followed.

The PRESIDENT: In the unavoidable absence of the Minister of the Royal Serbo-Croatian-Slovene Legation, we are fortunate in having his representative, Monsieur Subotić, with us to-night. I have pleasure in asking him to say a few words on the subject of the paper which has been read.

Mons. D. P. SUBOTIĆ: It has been a privilege for me to listen to this excellent and most instructive lecture, and I greatly appreciate the opportunity which is given to me of saying a few words. The Boundary Commissions established by the Treaty of Peace to draw, on the spot, frontier lines between various States bore, naturally, a pre-eminently political character. Their work, however, has been a very valuable contribution to knowledge, especially to the study of political geography. So many minute and delicate questions have been weighed one against the other by the most competent and impartial men, yet their final decisions have often hurt one or other, or both sides. The principle of ethnographic frontiers—a principle although not of recent origin, yet for the first time seriously applied in 1919—was applied in the case of

Yugo-Slavia more accurately than to any other State that inherited a large portion of the former Dual Monarchy. Following this principle, some boundaries of Yugo-Slavia are drawn so as obviously to damage the interests of the people on both sides. Such is the case especially in the Banat, between Yugo-Slavia and Romania; also in the north between Hungary and Yugo-Slavia. Here the frontier runs almost across the open plains, cutting rivers, roads, railway lines and private property, and really is a striking example of a bad artificial frontier. But in some places it is better. For instance, north of the town of Subotica the boundary is almost a natural one, as it runs over huge hills of sand which are still partly in motion, and are a serious obstacle to communication of any kind. But many landowners of Subotica have been deprived of large portions of their property, for they were forced to sell them, as they had remained within the Hungarian frontier. To the east and west of this town the frontiers are no better than those in Banat, separating Yugo-Slavia from Roumania.

But was there anything more difficult than to draw the frontier line between Yugo-Slavia on the one side and Hungary and Roumania on the other? To draw a perfect ethnographic boundary in this conglomerate of races was practically an impossible task. The result was that roughly 362,000 Yugo-Slavs remained within the Hungarian frontiers, while just over 472,000 Magyar-speaking people remained within those of Yugo-Slavia. I am afraid the Magyars seem, so far, to be unwilling to reconcile themselves to this fact, and to establish really friendly relations with the Yugo-Slavs, which would be of the greatest possible benefit to both sides and to Europe. Let us, however, hope that petty and unfriendly feelings will gradually disappear and that the Governments of both countries will strike the right way leading to a permanent friendly agreement.

Colonel H. S. L. WINTERBOTHAM: Boundary Commissioners, like other distinguished gentlemen who lecture before this Society, are rather apt to make more of their deeds than their difficulties. The difficulties a Boundary Commission suffers under are, however, manifold. Colonel Cree has spoken of the subject of maps. In the south-eastern part of Europe our knowledge of the country rests, unfortunately, on the unsupported testimony of the Austrian 1/200,000 map. That map is one which was made with more courage than measurement. It was made largely by people who travelled over the country in the guise of commercial travellers and such like. In certain instances you will find hills, streams, and other topographical features described by names which, in the vernacular, mean "I don't know." And there is a case, not on this particular boundary, but on another, in which the line is described as leaving a mountain of a certain name, running north-eastward, and leaving two villages, *A* and *B*, on the north-west, and one, *C*, on the south-east. In actual practice, *C* is on the north-west, *A* and *B* on the south-west. This line becomes, then, in practice a W. But such acute troubles with his maps Colonel Cree luckily escaped. Then there are the troubles of reconciling the views of the individual with the views of the politician. Strangely enough, the individual, when he is questioned, is often more anxious to remain of that country in which his market, his school, and his church are to be than he is concerned with the actual nationality. The politician, on the other hand, constantly concerns himself with the private prejudices of the unimportant individual, and has his eye on territory. A third thing we have to notice to-night is that Colonel Cree has described a Boundary Commission which has pleased everybody, and not only so, but it has pleased itself. It has been a happy

family. What better advertisement could one have for its President? I think we have all enjoyed this lecture very much, and that Colonel Cree has given us a most instructive evening.

The PRESIDENT: I should like to echo the sentiments which have been expressed by Colonel Winterbotham, and ask you to express your gratitude to Colonel Cree for the paper which he has given to us. In these days, when so much of the map of the world is in a state of flux, it is not very easy for the ordinary individual to maintain his geography up to date, and there can be no easier or, may I add, pleasanter way of having one's geography brought up to date for one than by listening to a lecture and seeing such maps and illustrations as those which have been provided for us to-night. I am sure we are very grateful to Colonel Cree.

THE DESERTS OF JAFURA AND JABRIN

Major R. E. Cheesman

Read at the Meeting of the Society, 15 December 1924. Map follows page 184.

THE inspiration of this expedition came from Lieut. Boyd Alexander. As long ago as 1908 he told me that if he came out of Africa alive he intended to make an attack on the Arabian Desert, to trace the connection between the birds there and the desert fauna of Central Africa. The tragedy that followed in Nieri is well known to you.

By a remarkable sequence of events, of which the Great War was one, I was attached some ten years later as Private Secretary to the only chief who would have countenanced such an irregular proceeding as this expedition by a member of his staff, or, having done so, would have gone further and made it possible by his backing and support; moreover, he was the only man who could have obtained the necessary permission if he would—I refer to Sir Percy Cox. By his own personal interest in the wider horizons, he enabled me to continue the quest that Boyd Alexander would have done so much better than I, had he but lived.

The object of the journey, therefore, was to bring back a collection of desert animals and birds from Central Arabia, a district represented by not a single specimen in the museums of the world, if we except a few examples of gazelle and oryx and, more recently, the Arabian ostrich which have found their way alive to Europe. I also wanted to investigate the distribution of resident birds and the movement of migrants through the Great Sand Desert lying on their direct route between Africa, their winter quarters, and the breeding grounds in 'Iraq, Persia, Caucasia, and further north. Naturalists have so far had to be content with nibblings from the coastal belt round the peninsula. There is indeed an excellent collection of skins made in the interior, as far south as Taima, by Mr.

Carruthers in 1909, but this is too far to the north and west of the Southern Desert to form more than a distant link in the Arabian faunal chain.

The few travellers who have succeeded in gaining the interior from the east have not been naturalists, and one can read the whole history of Arabian exploration without learning anything of the wild life to be found there. Here let me confess that in reading a book of travel I find it difficult to picture the country unless descriptions are given also of the fauna inhabiting it, and that my interest in the recent excavations among the Tombs of the Kings in Egypt has been aroused not only by the important discoveries made, but by the fact that the same species of bat which lives in the sandstone caves of Hufuf also haunts the tomb of Tutankhamen.

The happy personal relations existing between Sir Percy Cox and His Highness 'Abdul 'Aziz ibn Saud, the Sultan of Nejd, suggested an opportunity of visiting the interior, and in December 1922 Sir Percy Cox was able to obtain a personal invitation from the Sultan for me to visit him and collect in his territory. It remained only to obtain the British Government's approval and the permission of the Secretary of State for the Colonies, at that time His Grace the Duke of Devonshire, to avail myself of the offer. Permission was given in due course, and I gratefully acknowledge the help of the Colonial Office in making smooth the preliminary arrangements, and also the loan by the War Office of the most recent maps.

As soon as my destination was known, it was suggested by some one at the Royal Geographical Society that I could not possibly go and look for birds in Central Arabia without a theodolite. Not only was this the first theodolite to be taken into the country of the Wahabis, but the desert we had designs on, lying to the south of Hufuf, was that part generally implied by the term " Unknown Arabia." So little was known, indeed, that it may be correctly described as virgin desert, from 600 to 700 miles across either way.

In his ' Penetration of Arabia,' Dr. Hogarth tells us that only three explorers claim to have had distant views of its mysterious sands : " Wellsted from the crest of Jabal Akhdar in Oman in 1836 ; Wrede from a point north of the main Hadramaut Wadi in 1843 ; and Halévy on his passage from the Jauf of Yemen to Nejran in 1870 " ; but he says, in mentioning them, " Yet of none of these three can it be said with confidence that he looked into the true desert." * Since 1904, when this was written, our knowledge, so far as I can ascertain, has been amplified only by two travellers : Firstly by Major (now Sir Percy) Cox, who while Political Agent at Muscat made an expedition in June 1902 from Abu Dhabi, on the Trucial Coast of Oman, to the Jabal Akhdhar, and thence on to Muscat by the Wadi Samail. He speaks of the panorama which was spread before him as he scanned the horizon in the direction of

* ' The Penetration of Arabia,' p. 334. D. G. Hogarth. 1904.

Adam and the desert beyond from the slopes of Jabal Khadhar, a peak some 7500 feet above the sea, at the south-east extremity of the crest above Muti; and secondly by Mr. Philby, who has recorded in his 'Heart of Arabia' various items of information derived from any Badawi whom he met in passing along the caravan routes skirting the desert on its northern and western fringe. Thus there was in literature no first-hand information of a country which is to-day a blank on the map and which has defied all attempts of Europeans to lift the veil. The reason is not far to seek: the greater part is waterless, and therefore uncrossed by any caravan route in any direction. Even an Arab takes the longer way round the edge, where he can find occasional wells, in preference to risking his own and his camels' lives by taking a short cut across, which at his fastest rate of travel would mean a month without water in normal years.

Philby's informants were able to throw some light on the conditions of life and the country of the little-known * Al Murra tribe that roam the northern part of the Great Desert, but it was necessary, when I eventually reached the places, to make two corrections of the positions he mentions in his book and map. Jafura, which he indicates as lying some 150 miles south of Jabrin, is really the sand-dune desert of Jafura, north-east and east of Jabrin, and actually the north-eastern arm of the Great South Sands. Also the wells of Al Khin and Al Haradh, and two others that he was told lay in the Wadi Sahba channel on the way between Hasa and Jabrin, must be deleted, as I neither saw nor could hear of any wells there. My Al Murra guide said Al Khin was a well with a few palms south of Jabrin oasis, which I subsequently saw, and Al Haradh that occasionally holds rain-pools he placed north of Sahba in the direction of Riyadh; but I could find no clue to the other wells.

The Royal Geographical Society not only equipped me with the necessary instruments, but have extracted from the figures of the observations taken there, the latitude and longitude of 'Oqair, Hufuf, and Jabrin, and the latitude of Wadi Sahba.† All these had been provisionally placed on maps, but their positions had not been determined. Philby had, however, obtained the latitude of Hufuf.

A Baghdad Arab boy, Mehdi, accompanied me. He had been with me several years and had acquired considerable dexterity as a skinner, added to which he had been given a finishing course at the British Museum (Natural History) while we were in London preparing for the expedition. The interesting series of desert-coloured forms brought back was in no small part due to his industry in trapping and preserving, and he also had to assist with the instruments when observations were taken, as I found single-handed night work with a theodolite well-nigh impossible.

* This is Àl, a family, not Al, the article.

† Spelt Wadi Sahaba on previous maps, but the middle *a* is not pronounced by the Al Murra.

He was moreover a Mussulman with broad and elastic convictions, and could be trusted to avoid being led into heated religious discussions in the fanatical atmosphere of Wahabism.

Leaving England on 4 October 1923 we arrived at Bahrein on November 14. Major Daly, the British Political Agent, kindly put me up until the little sailing boat should be ready to start for 'Oqair, the port on the Arabian mainland. He had previously sent a message to Shaikh Abdullah ibn Jiluwi, Governor of Hasa, asking him to send camels to the coast to take me to Hufuf on disembarking. On November 16 we sailed out of Bahrein harbour and landed at 'Oqair after twenty-four hours at sea.

From the moment of landing at 'Oqair one is in the territory of an entirely independent sovereign. The Sultan of Nejd and its Dependencies, a Principality with an area roughly as big as England, France, and Germany combined, and a population equal only to a quarter of that of London spread over the whole. Many square leagues are, as far as is known, uninhabitable waterless desert, and the rest is only partially peopled with roving tribes who wander with droves of camels over vast plains according to the seasons. Their movements are guided by the rains, or rather by the vegetation which springs up in their wake. One year a single tribe may be driven 200 miles north and in six months as many miles south of the centre of their territory, the boundaries of which are more or less fixed by traditional rights to the use of wells.

Towns often 150 miles apart are confined to the bigger oases, where the supply of water available regulates their size and importance. Here only are agriculture and other industries, and the conditions of a sedentary population, made possible.

The present Sultan is descended from a long line of tribal chieftains. His rule is autocratic, and his complete independence has been recognized by the British Government, with whom he is in intimate treaty relations. It seems as well to make it clear that the Sultan of Nejd is under no measure of subordination or responsibility to the neighbouring states of the Arab Peninsula, except as may be provided for by treaty *inter pares*.

The creed of Central Arabia is (in addition to Wahabism, a sect of puritan Muhammadans) Arabia for the Arabs and exclusion of the foreigner. Hence the commerce of the country knows no financier but the Arab; nor does the Indian, Greek, or Armenian trader batten on an industrious population, because they are not allowed inside the frontiers. The keystone of the present ruler's foreign policy has always been, and still is, the maintenance of a friendly attitude towards Great Britain; but his military and civil Government, defence of his frontiers, and his finance are his own affair. He has made and holds a great position by his own statesmanship, based on the religious bond and a tribal code which are acceptable to his proud and truculent subjects. No languages except Arabic and the Badawi dialects are heard in the interior. A

traveller who could not converse in Arabic, and was unaccompanied by a competent interpreter, would be quite unable to make his way in the country.

The navigating officers of ships passing up and down the Persian Gulf complain of the inaccuracy of the position of many of the prominent hills and landmarks on the charts of that sea, and 'Oqair was one of the places the position of which had never been astronomically determined.

The local Amir met me as we disembarked and announced the arrival of two soldiers with the camels, who were anxious to start at once for Hufuf. It seemed inadvisable to open out an alarming array of instruments at once, as I had come with an invitation to shoot birds and felt I should be on probation for a week or two ; and on my behaviour the success or failure of the future would depend. An excuse for delaying departure for two days was made to set traps for mole rats (nesokia), whose burrows had been marked down on a previous visit. In the meanwhile a reason for taking the desired observations occurred to me which combined the advantage of plausibility and truth and served me well throughout the whole of the expedition.

I explained to the Amir and soldiers that when we came to take birds in strange places, it was necessary to take readings of the sun and stars there, as on my return to England some one might dispute the fact that I had actually been there, and my proof lay in the readings of the heavenly bodies. The Amir inquired how, if no one had ever been before to a place, any one could know what figures the stars would give there. This was somewhat of a poser. I replied that the wise men of London knew the correct numbers for such places as Constantinople and Bahrein, and from that could calculate what the reading of places situated between them should be. Thus the evening was spent in taking east and west stars and Polaris, and the following day the sun east and west of the meridian and on the meridian. During the setting of the traps about a mile from the fort, my attention was attracted to some birds in a zizyphus tree in the Amir's garden at Abu Zahmul, a small patch of lucerne watered by lift from a brackish well which is the sole horticultural effort of 'Oqair. On arrival at the garden, a series of mounds strewn with a litter of blue pottery reminded me of the ruin fields of Babylonia. A short inspection revealed the fact that I was in the middle of what was once a large city. Mounds of rubble and lines of mounds radiated in all directions, covering an area of about one mile long by half a mile wide. None equalled in size the mounds of Babylon or Susa, the highest being 6 to 8 feet, but it was possible to trace the outline of spacious houses and streets. The brackish well seemed to be in the midst of an open square. The walls had been built of slabs of local coral rock, now lying in tumbled confusion at their bases, and there were remains of what appeared to have been a wall which once enclosed the city. There seemed every reason to believe that I had at last found the site of Gerra, the ancient Phœnician

port. Some three years before its quest had led me to 'Oqair, but, passing just out of sight of these ruins, I had travelled southward for four days to Salwa along the most desolate sea-coast conceivable, but had found nothing to suggest the lost city.

My researches in literature on the subject of the site of Gerra may be briefly summarized. It is widely scattered in books from those of the earliest historians to those of the present day, and I have had the advantage of being able to use the material of a work not yet published, by Sir Arnold Wilson, who kindly sent me a copy of his memoranda.

D'Anville * favoured Qatif, a port on the mainland 80 miles north of 'Oqair, and northward even of Bahrein Islands. Forster † criticizes him severely in these words: "How D'Anville, who here, as usual, is followed by Gibbon, came to confound Gerra, the great ancient emporium of the Persian Gulf, with Katiff is to be accounted for only by his avowed and most unjust depreciation of the ancient authorities." He (Forster) then goes on to give his own interpretation of the positions given by Ptolemy, Pliny, and Strabo as proving the city to have lain to the south of 'Oqair in the southern extremity of the Gulf of Salwa, and thought he had confirmed this by the discovery of some ruins shown at that very place on a chart made by officers of the East India Company. Forster's theory has in turn been disproved by my own journey to Salwa in 1921 (*Geogr. Journal*, November 1923), in which the Salwa ruins were found to consist of the remains of two castles—too small to suggest those of a city described as a great emporium. Heeren is largely in agreement with D'Anville, while Charles Niebuhr is in favour of Kuwait. Sprenger ‡ says, "Ptolemy places the town Gerra on the coast, and he means without doubt Al Oqayr" ('Oqair). Philby § inclined to the belief in the ruins at Salwa, but draws attention to the strong resemblance between the name of Gerra and of the modern 'Oqair (pronounced Ojair).

The rest of the authors I have read do not definitely identify the ancient city with any modern port. Dr. Hogarth mentions the possibility of the site being found in Khor adh Duan—south of the modern Qatar—on evidence procured from natives by Colonel Miles that the estuary of the Wadi Aftan lay there. As I am almost convinced that Khor adh Duan is in fact the mouth of the Wadi Sahba, it would be a favourable site, providing that the Sahba was a functioning watercourse during Gerra's palmy days, which I doubt. Although I am quite prepared to be persuaded that any of the other claimants are the site of the missing city, my opinion is, from the evidence before me, that it is to be found at 'Oqair, basing this on four points: the position given in Ptolemy's

* 'Compendium of Ancient Geography,' D'Anville. 1791.
† 'Geography of Arabia,' Rev. Chas. Forster. 1844.
‡ 'Ancient Geography of Arabia,' Sprenger. 1875.
§ 'The Heart of Arabia,' Philby. 1922.

Geography, the resemblance between the two names, the splendid natural harbour, and my recent discovery of the ruins of what must have been a town of considerable importance at 'Oqair.

We now know of the ruins, but the definite proof, such as Phœnician relics would give, is still required. On my return to 'Oqair, some four months later, I paid a hurried visit to the mounds, and picked up some of the broken pottery and a coin from the surface. The pottery was mostly of blue glaze, whose art was known to the craftsmen of the earliest time, and which is still made at the present day. It is therefore difficult to date it, but Mr. Hobson of the British Museum, who kindly examined it, was of opinion that it was about sixteenth century; and Mr. Allen identified the small copper disc as a sixteenth-century Turkish coin. We can say only that it is probable there was a post-Islamic settlement on the site. The ruins themselves look older than this, and it is possible that if the top strata were removed, the evidence of an older civilization would be revealed. Later on in Hufuf, Muhammad Effendi, a revenue official, told me that earthquakes occasionally occur there, and it seems to me we have to look to upheavals to solve this, as well as other hydrographical problems of the Hasa province.

The ground-level of the coast has the appearance of having been raised in comparatively recent times. If so, it would account for the ruins being now a mile from the sea, and also for the disappearance of wells. The present water-supply would seem quite inadequate for the needs of the large city outlined by the ruins. Tectonic movements might explain why the Wadi Sahba, after cutting a course a mile wide across the Jafura desert to the sea, now flows no more, and also might throw some light on the warm gushing springs of Hufuf.

While walking near the sea at 'Oqair, above high-water mark but not far from the waves, my attention was arrested by a shrill sound issuing from the sand about me. Every footstep brought forth a response in the form of a loud whistle apparently from a distance of a few paces and lasting about five seconds. I had heard it before in Basra in 1915, and as Mole Crickets were very plentiful at that time, these insects were associated in my own mind with the noise. I expected to find that it was their warning note or that of some ventriloquial insect, as he heard my footstep and hurried below. I made a determined effort to catch one at 'Oqair. A more elusive quarry could scarcely be imagined. As one advanced the piping burst forth behind, and on turning it would be repeated five paces to the right or left, and so on for an hour, until I was utterly weary and defeated.

It was not till I had returned to England and read Lord Curzon's 'Tales of Travel,' that I realized that this was the phenomenon of the Singing Sands or Musical Beaches. In this book all the literature on this and the kindred though distinct problem of Sounding Sand Dunes has been collected, and the various theories advanced and accounts of

travellers are lucidly reviewed and discussed in a chapter devoted to the subject.

In all cases quoted by Lord Curzon, the investigators of Musical Beaches have accepted the hypothesis that the noise was made by the sand itself, but from the amount of evidence available, I do not yet feel satisfied that this is proved. One experimenter claims to have reproduced the noise by squeezing the sand in a stocking, but I cannot convince myself that he heard the real sound of the Musical Beach in the first instance.

The description in that chapter which comes nearest to the piping I heard at 'Oqair is "the noise made by rubbing leather on wet glass." This is a sound unlikely to be reproduced by the squeezing process, but unfortunately, as I did not read 'Tales of Travel' until after my return, it was not possible to put it to the test.

That electricity is generated by the friction of the sand-particles seems to be generally accepted. My brother, an electrical engineer, has given me an instance culled from the 'Personal Recollections of Werner von Siemens,'* brother and companion of Sir William Siemens, the eminent scientist who died at the end of the last century. During the laying of a cable in the Red Sea in April 1859, Werner von Siemens visited Cairo, and was standing with ten engineers at the top of one of the Pyramids while a chamsin was blowing—a strong wind laden with sand. He noticed a remarkable hissing noise which could not have been caused by the wind itself, and when he raised his outstretched finger above his head a sharp singing sound arose, accompanied by a prickling sensation in the fingers, which ceased as soon as the hand was lowered, and a slight electric shock was experienced when he tried to drink out of a wine-bottle. This discovery led to a further development, and he improvised a condenser by wrapping wet paper round a bottle of wine with a metallically coated neck, and accumulated enough static electricity to give him a spark half an inch long. The Arab guides now decided to conduct their visitors down again with all possible speed. Siemens, however, was enjoying himself too much to allow any interruption, and, when his guide came near enough, lowered the bottle towards the Arab's nose. The electric shock, which Siemens also felt in his arm, caused the guide to emit a loud roar and fall flat on his face, after which he leapt down the Pyramid and the other Arabs joined in a general stampede, leaving the magician in peace.

On November 19 we left 'Oqair at sunrise and spent the day crossing the 40 miles of loose sand-dunes to the Hufuf oasis. The night was spent at Jisha, the first village of the oasis, leaving a comfortable 10 miles march next morning through avenues of palms to the reception hall of

* 'Personal Recollections of Werner von Siemens.' Translated by W. C. Coupland. 1893.

the Governor in the middle of Hufuf town. Shaikh Abdullah ibn Jiluwi has been well described by Philby and others, and there is little more for me to say about him or the principal town of his province.

He was seated at the far end of a long reception room that was crowded round the walls with officials, slaves, and soldiers in bright red or black cloaks with gold embroidery and curved swords with silver-chased scabbards. He himself was more simply apparelled, but had a gold scabbard to his sword. He rose to shake hands with me, and placed me on a seat next to him and introduced me to Muhammad Effendi, the Revenue Chamberlain and factotum who was made responsible for all arrangements for my comfort during my stay.

Although the figure of Shaikh Abdullah is a little too squat to be that usually described as military, one is not long in realizing one is in the presence of a man who is first, last, and always a soldier. The very atmosphere of his court is discipline—not perhaps the ordered ritual of our own military system, but rigid discipline all the same. When he stands every one in the long room rises with the accompaniment of the clatter of swords. When he calls for coffee, there is a ring of an order in the voice which is taken up and repeated by gruff voices down the room, and is relayed through the door and down the long staircase, each step of which is guarded by an armed slave, and so the order " gahwa " fades in the distant corridors, and on the wings of the echo up comes the coffee. It never occurs to any of his staff to question or delay an order of Shaikh Abdullah.

My first formal visit was only of a few minutes' duration, and conversation was confined to light and polite question and answer. Suggesting that I was weary after my journey, he called a soldier to conduct me to the guest-house, which with a staff of servants is always placed at the disposal of European visitors. In addition two soldiers were detailed to accompany me whenever I left the house ; one brought a complete set of Arab clothes, with a request from the Governor that I would accept and wear them, and I was warned that it would be inadvisable to be seen smoking in the streets, though indoors it was immaterial.

During my stay in Hasa I re-read both Palgrave's * and Philby's impressions of that place, and, with the advantage of being on the spot and holding a brief for neither, was able to sit in self-appointed judgment on the two accounts and on Philby's criticism of Palgrave. The decision was that they both must have been there. Philby rightly challenges many of Palgrave's statements, but when he suggests that he never went there I cannot agree. The picture Palgrave painted of Hufuf, its garden and its industries, is to my mind exactly as I saw them, and could only have been composed by an eye-witness. It seemed however that, though both artists had painted the same subject, I had the canvases of

* 'Central and Eastern Arabia,' W. G. Palgrave. 1862-63. 'Heart of Arabia,' H. St. J. B. Philby. 1922.

two different schools : one by Philby, the Pre-Raphaelite, who when he paints a daisy chain is careful to have the correct number of petals to each daisy, whereas Palgrave, the Impressionist, gets his effect of the daisy chain without even the right number of daisies. Palgrave was doubtless asked many questions when he arrived home, and rashly tried to satisfy his public by filling up gaps and embellishing his topics from an all too-lively imagination, where a golden silence or a confession of lack of observation would have been more valuable.

The buffalo was a blazing indiscretion, as he could not possibly have seen them, as he said, wallowing in the pools of Hasa ; nor could any one who had been in India, as he had, mistake them for domestic cattle. I asked townspeople and garden owners if the buffalo had ever been introduced, and they all said no, and added that no one would be likely to try the experiment as conditions there were unsuitable. So I think we may consider this as proved. Another instance occurs, although not one of those mentioned by Philby, in which Palgrave inserts an incorrect paragraph on the stars, apparently with the desire to impress the reader with his knowledge of astronomy. In describing his departure from Buraida by night, " Canopus glittered in all his splendour to the South " ; had he left it there all would have been well, but being Palgrave he added, " and Orion was to rise before long." Had he studied a star map he would have seen that Orion is well up in the sky when Canopus rises.

Palgrave states that while in Buraida he saw a whole string of camels, the head rope of each tied to the crupper of his precursor—very uncomfortable passengers, he says, when met at a narrow turning. Philby comments thus : " The practice of connecting the animals of a caravan in this manner is certainly not prevalent in Desert Arabia, and the only occasion I met with it during my sojourn in the country was on the road between Taif and Mecca in the Hijaz." This is a decided win for Palgrave, as during my stay in Hufuf I met two strings of camels in a narrow path tied exactly as he narrated, and I can appreciate his view of their unwieldiness. As it is no uncommon practice in Hufuf and Hejaz, we can assume he saw them as he described in Buraida. Philby also incautiously enters the arena on a question of corn grown in Hasa, and states that according to Palgrave almost all *legumina* and *cerealia*, barley excepted (at least, he adds, he never heard of any), cover the plain. Although the few words about the absence of barley are the only strictly accurate part of Palgrave's sentence, Philby directly contradicts them with the statement that " barley grows profusely." I was told that the only barley that enters Hufuf is imported from oversea by Ibn Jeluwi for his horses, and I was able to confirm this by examination of all the corn crops passed. They were invariably wheat, though in justice to Philby it is necessary to mention that there was one small patch of lucerne which had tufts of barley planted round the edge. Nevertheless, the harvest of this would no more than fill a bushel.

Most of Palgrave's agriculture and horticulture is misleading, partly because he was not equipped with the necessary knowledge of the subject and sometimes owing to sheer inaccuracy. An example of the latter is his mention of animals used in Hufuf for ploughing, when he ought to have been aware that ploughs are unknown there and all cultivation is done by hand. There were two plants given in his list which are not so preposterous as they at first appear, namely the Papay tree and sugar-cane, neither of which grow there, as Philby points out. The Castor-oil plant does grow, however, and owing to similarity of shape of leaf and colour of foliage might easily be mistaken for the undergrown Papay tree Palgrave says he observed. Again, the sugar-cane he saw being sold by retail bundles in the market-place, from which purchasers take it home to gnaw at leisure in their houses, may well have been in reality the succulent underground stems of a peculiar desert plant (*Cynomorium coccineum*) called Tarthuth. They are pinkish, are sold in baskets in the bazaar, and the purchasers walk about gnawing them as the natives of India do the sugar-cane, and the mistake in identification would be excusable.

Travellers visiting Hufuf have omitted to emphasize sufficiently the strangely shaped Eocene calcareous sandstone hog's-back hills, such as Jabal Qara in the east, Jabal Abu Ghanima north-west, and Jabal Arba south-east. They lie outside the cultivated area at distances of 3 to 12 miles, and towering 200 to 300 feet above the plain, are conspicuous features in the landscape. Sand erosion on the soft under strata cuts them into grotesque and top-heavy figures. In Jabal Qara there are caves supposed to penetrate to the centre of the hills, which were visited by H. Burckhardt in 1904. A magnificent view of the oasis rewards a climb to any of the hill summits.

There must be few places in the world that can boast such a perfect winter climate as Hufuf. My maximum and minimum readings were: For November—Shade, 60° to 71° F.; maximum in sun at noon, 84°. December—Shade, 51° to 77°; maximum in sun at noon, 92°. January —Shade, 48° to 76°. February, on the march between Hufuf and Jabrin—Shade, 37° to 92°; maximum in sun at noon, 111°. The wind was as a rule little more than a breeze, and was very dry. The rainfall during the four months was about half an inch, and it was considered an average year.

As one walks or rides along mile after mile of the pathways through avenues of tall date palms, all the ground beneath is carpeted with green lucerne, among which large butterflies, such as the Common Swallowtail (*Papilio machaon*) and the Lime Swallowtail (*P. demolius*) an Indo-Malayan species, search out the purple blooms. On one side, often on both, are rushing streams of crystal water, so clear that every pebble on the bottom can be seen among bright green feathery water-fern (*Ceratopteris thalictroides*)—a rare plant that has but this one representative

of the family—and long ribbons of other water-weeds that bend and sway with the force of the current. Here and there are masonry culverts of rough stone blocks, the crevices clustered with maidenhair ferns (*Adiantum capillus-veneris*). Some of the gems of this place are the little bright-coloured fishes (*Cyprinodon dispar*), the size of a small sardine, that live in the hot water. I found them in the Umm al Saba, the hottest spring, and took the temperature at 101° F. By medical definition a hot bath begins at 96°, and 101° is as hot as you want it. The natives say that if the fish are put in cold water they die. It is not easy to suggest how they got into these isolated waters, or how they withstand the high temperature.

In the trees the White-eared Bulbul (*P. leucotis mesopotamiæ*) and a new subspecies of Wren Warbler (*Prinia gracilis hufufæ*) are plentiful, and in one step they are left behind on issuing from the edge of the cultivation, for all is barren plain and sand.

In the limestone hills there was a pale example of the Desert Eagle Owl (*Bubo bubo desertorum*), only to be matched in colour by specimens from Aïr, in Western Sahara. Sitting immovable amidst the sandstone crags, with which their colouring completely harmonizes, they watch with gorgeous yellow eyes for jerboas, scorpions, larks, and beetles. Two species of Desert Larks (*Ammomanes cinctura pallida* and *A. deserti azizi*) were also obtained there, one a new race, and a pale crag martin (*P. obsoleta obsoleta*). The colour of the birds and animals has responded to the influence of the white cliffs and rubble among which they make their home.

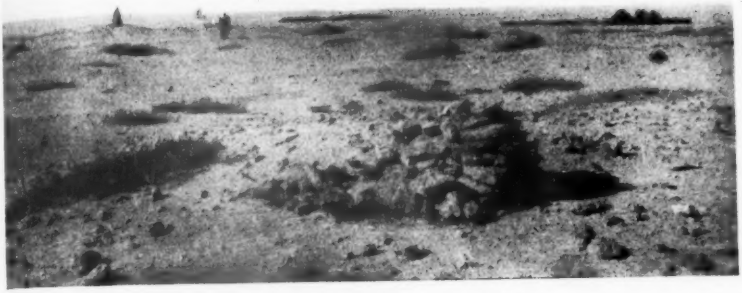
From November 20 to January 15 I was waiting permission to continue my journey to Jabrin. Sir Percy Cox, in a letter to the Sultan, had suggested this journey among others, but we were doubtful if permission would be given for an expedition to such an inaccessible region. So with no little surprise and much inward rejoicing I received a message that if I very much wanted to go to the "South," it could be arranged if there was rain enough to provide food for the camels on the road. The previous year had been entirely rainless and had laid the country bare and scorched. There was nothing to do but wait and hope for rain and fill in time with short excursions round Hufuf.

On January 15 the Sultan, 'Abdul 'Aziz ibn Saud, arrived in Hufuf from Riyadh on affairs of state, with wives and sons and their wives and a large retinue of soldiers and camels, and he repeated his Governor's opinion that if I would go to Jabrin I must wait till reports came in of sufficient grazing to support the caravan. It was not until February 9 that we were to leave for the South, rain having fallen meanwhile. Subsequently I was able to see for myself that the delay was justified, as the bushes were only just shooting. Had we attempted the journey earlier, our camels would certainly have deteriorated from lack of food, and some might have been left to die.

The Sultan is a handsome man with a tall, commanding figure. Combining statesmanship of a high order with great personal charm, he is the reverse of the misleading character sketches of him which frequently appear in the European press. Having engaged an architect, a native of Hasa who has served his apprenticeship in Bushire, he is engaged on remodelling the buildings of Hufuf town in a style which introduces the rounded arch and will certainly create a period in its history associated with his reign. He was delighted when I complimented him on his new buildings, and said he hoped eventually to remove all of the older style with the angular, or, as he called it, Ibrahimi arch, made by two inclined date logs meeting in the middle, and replace them with the new ; but, he added with a smile, " We have to advance gradually, as money is not too plentiful." Apparently he had much say in the design of his new palace, which retains Arab predominance, whereas the new market colonnade and the house of the Qusaibi family show a distinct Persian influence.

An hour before our departure for Jabrin on February 9 a message arrived from the Sultan suggesting that the venture should be abandoned, as news had just reached him that a raiding party of Awamir, a wild tribe of Badawi living in the southern desert some three or four days south-east of Jabrin, had carried out a murderous attack on the Al Murra at Jabrin, whose guest I was destined to be ; they had killed ten families and had stolen their camels. He explained that the Awamir are nominally under the rule of the Sultan of Oman at Muscat, but, owing to the inaccessible wastes in which they live, no one was capable of exercising any control over them. I hastily replied that, not being there as an official representative of the British Government, he, Ibn Saud, would not be held responsible for my safety, and, being a private individual, I was in a position to take that responsibility on my own shoulders after his kind warning. I also wrote and signed a memorandum to that effect. This satisfied him, and we left.

As guide a member of the Al Murra tribe, named Saleh, was attached to the caravan. In desert craft he can have had few equals. His knowledge of the footprints and habits of all the animals and birds of the sands was never at fault, and, all this being new to me, he found an enthusiastic pupil. For one species of lizard he would leap from the camel and give chase to cut off its retreat to its burrow, while for another kind he would calmly wait till it had run some distance, where it stopped and lightly buried itself in the soft sand. He then took my collecting tin, leisurely walked to the spot, and picked it up. He knew by the footprint of a hare if it was squatting near by or not. In passing the tracks of camels, he could read their date, whether loaded or ridden light, and more or less the history of the party. His sense of direction was developed to a degree that was marvellous. For days we were to march over a featureless level gravel plain. My only landmark was a circular horizon as flat



RUINS AT ABU ZAHMUL, 'OQAIR

THE BAZAAR, HUFUF

SULTAN'S PALACE, HUFUF

NORTH GATE, HUFUF

and regular in every direction as that of a calm ocean. Yet he scarcely deviated by a degree from the straight course he had set in the morning, for, in curiosity, I kept a check on him with my compass.

It has been suggested that the Al Murra may be the original inhabitants of the land; I think we may assume they are pre-Arab, although they speak Arabic in addition to their native tongue. Up to two years ago they were pagans. Since the present Sultan's conquest of the Hasa the Murra tribe has not only been controlled by an outside administration for the first time in its history, but is now rapidly embracing the Muhammadan faith. They told me their enemies, the Awamir, speak an entirely different language, and described it as a series of grunts. As intercourse between the two tribes is confined to cutting each other's throats at sight, opportunities for linguistic comparison are necessarily limited. The Al Murra type of face reminds me of features to be seen on early Sumerian sculptures. It is not unreasonable to suppose that they are the remnants of this, the earliest civilization. The conquests and passing of nations on the trade routes would leave them unaffected and unchanged in the fastnesses of their desert stronghold. In addition to the two soldiers of the Governor, the caravan included a Qahtani and a Dawsari, representatives of tribes from the western side of Al Rimal.

Here it must be mentioned that the name of Ruba al Khali (the empty quarter) marked on maps in big letters is not used by the people of the Hasa and the north for the Great Southern Desert. It is not even understood. The correct name there is Al Rimal, pronounced Arimal (the sands), sometimes varied by Al Janub (south country), although this might include the oases beyond the actual desert, such as Nejran.

Two short days' marches brought us to Zarnuqa Well, the most southern water of the Hasa. From there to Jabrin, six days further south, we were to exist entirely on water-skins, and the camels were not to drink at all. Wadi Sahba is said to retain rain-pools in exceptional years, although it has not been known to flow. As it is six years since that district had good rains, the Wadi is never relied upon for water.

Zarnuqa Well is important to the Al Murra, as it is here they make a base when their camels are browsing in the bush-clad sand-dunes of the waterless Jafura desert to the east and south, returning every five or six days to water the camels and replenish water-skins. The well, although dug through hard limestone, is in the trough of and surrounded by high moving dunes.

Our straight course between here and Jabrin now lay entirely through sand-dunes, but we were able to avoid them by bearing a little west of south where a level gravel plain called Saramid marches with the edge of the dunes. Mr. W. Campbell Smith, of the British Museum (Nat. Hist.), has kindly examined the pebbles, and says they are the *débris* of a conglomerate, probably Pliocene, the pebbles themselves being derived from a previous land surface probably earlier than Cretaceous. The

NORTH GATE, HUFUF

SULTAN'S PALACE, HUFUF

grading of these pebbles according to size on the plain compels notice, and it is not clear to me by what agency it is accomplished. In one spot all the stones are the size of peas, in another they are like walnuts, and elsewhere there are groups as big as a man's head. We travelled for several days with the high dunes of Jafura in sight to our east. Thus we were saved the discomfort of ascending and descending these wearisome sandhills during the day, and were able to enter them at night to camp in the shelter of the hollows. The camels found grazing among the shrubs that grew in the sands, whereas the gravel plain was almost bare. To illustrate the desolate conditions of this vast desert I took a photograph of a Brown-necked Raven's (*C. C. ruficollis*) nest built within reach of the ground in a leafless bush 8 feet high, without any attempt at concealment. The raven in all countries shows a remarkable intelligence in selecting the most inaccessible positions for its nest, but here all such precautions had been abandoned as unnecessary. Probably for countless generations these birds and their ancestors had reared their young in these conditions, and no one had passed by to disturb their peace. On several mornings we rose to find the dunes covered with a heavy dew that soaked everything, although the sky was cloudless, and bushes were dripping water on to the sand. Any of the desert animals could have obtained all the moisture they wanted by licking the bushes. The rising sun quickly dried the surface, but on scratching away the first inch or so of sand the underlying strata were found to have absorbed and retained the moisture which sun and wind failed to evaporate. This accounted for the flourishing condition of vegetation in the dune country as compared with the dried bushes on the gravel.

At dawn on February 15, in camp among the Zaida Jafura dunes, there was a thick white fog, and objects at 100 yards were invisible. The temperature had fallen to 37° F. Later a ghostly white rainbow, without any colours, appeared on the fog at a distance of 20 yards, if you turned your back on the rising sun. As the Hasa is left behind the outcropping chalky sandstone hills are smaller and eventually die out, leaving a seemingly endless plain without any landmarks on which to take bearings.

A narrow tongue of high sand-dune country, called Barqa Dhumairan, traverses the entire gravel plain from eastward to westward, and Saleh said it joins the sands of the Jafura with those of the Dahana. This strip was but a mile or two wide where we, travelling north to south, crossed it.

Our fourth waterless day brought us to Wadi Sahba, and we camped in the bed. The entrance to the channel is sudden, as the land does not fall perceptibly towards the river until you are close to the banks. It seems unlikely that even in the days when it was a watercourse it has ever drained this part of the peninsula, but has merely carried the water from the Nejd mountains across these flat plains to the Persian Gulf.

I was the first European to see Wadi Sahba, and was able to confirm

its position here. This, with the further results of my journey to Jabrin, enables me to sound the death-knell of two immense rivers or drainage channels that have figured largely in Arabian geography, from the earliest times, under the names of Wadi Jabrin and Wadi Aftan.

Sadlier first threw doubt on Wadi Aftan as a perennial river in 1819.

Chedufan and Jomard in 1839 believed that Wadi Dawasir collected waters draining from the direction of the Red Sea and discharged into a permanent lake, Bahr Salume, which overflowed thence by the Wadi Aftan across the great Southern Desert, to the Persian Gulf.

Ritter ('Penetration of Arabia'), in 1845, held that if Wadi Aftan existed, it could reach the Persian Gulf only by underground channels.

Palgrave in 1862 revived the Wadi Aftan, though he accepted it as having ceased to function as a river; he even thought he tracked it in its whole length, but, as Philby points out, he made it, or its tributary the Hanifa, run backwards.

Philby in 1917 chased Wadi Aftan from Riyadh southwards to Dawasir, and, had it existed, he must have crossed its bed at right angles. His inquiries failed to discover any local knowledge of a wadi of that name, and he ended by considering it non-existent.

No traveller has been able to obtain sufficient information to confirm or deny the existence of Wadi Jabrin; it has therefore retained its map position as a possible drainage artery of a bygone age. Mr. Douglas Carruthers, in a footnote in the *Geographical Journal*, May 1922, p. 234 —"Captain Shakespear's Last Journey"—summarizes our knowledge of the subject up to 1922 in these few words: "The destination of the Wadi Hanifa is one of the important problems in Arabian hydrography. The question of the mysterious Wadi Yabrin and the problematic Wadi Aftan of early Moslem geographers are both closely bound up with the ultimate destination of this great drainage. It seems that, above ground or below it, the Hanifa and its tributaries do drain across an intervening 250 miles of unexplored waste to the Persian Gulf."

My recent experience leads me to reconstruct the hydrography of this side of the Arabian peninsula. Jabrin is a basin in a sandstone outcrop; Wadi Jabrin therefore must, with Wadi Aftan, which appears to have no source, no channel, and no estuary, be dismissed as myths. Wadi Sahba, having all three, replaces them. Colonel Leachman, Captain Shakespeare, and Mr. Philby have left little doubt that Wadi Hanifa, with others, drains the Nejd highlands and runs near Yamama to discharge its waters into the Sahba depression somewhere in the sands. They heard, and I have confirmed, that in old times the waters cut a channel across the desert, falling by an easy gradient to the Persian Gulf. The altitude of Wadi Hanifa at Riyadh is about 1920 feet; at Yamama 1108 feet; and still further on, south of Hufuf where I crossed it, now called Wadi Sahba, 763 feet: to sea-level about 80 miles eastward at the Gulf. Colonel Miles obtained information that a saline depression

near Khor adh Duan * on the Persian Gulf was continuous with Wadi Jabrin and was also connected with Wadi Hanifa, one of the main drainage channels of Nejd. The Al Murra told me that although completely blocked by the Jafura sands the Sahba channel could be traced to the Persian Gulf south of Doha. So probably Miles's informant was correct in indicating Khor adh Duan as an estuary, although he omitted any mention of Wadi Sahba and only links it with its tributary Hanifa. Miles's mention of Jabrin as a wadi was probably merely a repetition of the error from a map that showed it as such.

I found the Wadi Sahba a well-marked channel about a mile wide between sloping banks some 50 feet higher than the bed. There were pebbles embedded in a hard white substance that looked as if it might once have been fine silt. The two now look like a conglomerate. I brought specimens of this, as well as sand from a foot below the surface in another place, the top layer being obviously drift sand from the surrounding wind-swept plain. Mr. Campbell Smith has examined them, and says both the pebbles and sand are water worn, and, as I did not find this particular formation beyond the banks on either side, where pebbles show only wind action, I am convinced it was the actual bed laid down by the flow of the river. Unfortunately this does not enable us to date the period when the river was a running stream. At the present day the annual storm waters of Nejd can scarcely reach the channel of Wadi Sahba before they are swallowed up in the sands. The land slope makes it possible that these waters reappear in the perennial flowing springs of Hufuf and Bahrein. If so, the Arabs' folk-lore of underground rivers is not so far from the truth.

The estimation of the direction of fall in these large dry wadis was extremely difficult, and without the evidence of my instruments I should have been unable to convince myself which way Wadi Sahba once flowed. Also to ascertain whether one is ascending or descending on the vast almost level gravel plains is quite impossible. One seems to be moving in a shallow basin the rim of which, the horizon, surrounds you on all sides and to which you appear never to get any nearer.

It is in the Sahba region that certain stones, according to the Badawi, are seen to walk about. The gravel plains on either bank are similar to those we had passed over in the Jafura and Saramid gravel So confident was Saleh that in one of these districts we should meet a pebble actually on the move that we spent hours with our eyes on the ground as we marched along, searching for the zig-zag track they are supposed to leave. They are the size of a hen's egg, and may be either black, white, or red. For hundreds of miles the ground is thickly strewn with pebbles of the most amazing shades and shapes, all polished by the action of the sand. It is therefore small wonder that the superstitious nomads have conjured up in their minds the ruins of ancient cities and broken statuary.

* Sometimes spelt Khor-adh-Dhuwaihin on maps.

It is difficult to realize that the smooth surfaces are the work of nature and not that of a skilled jeweller.

Saleh eventually brought me a white round stone that he said might be expected to walk at any moment. It is now in the British Museum (Nat. Hist.), but I have not heard that it has shown any inclination to move. It would be unwise to dismiss the subject as being entirely due to superstition. Quite possibly the phenomenon is caused by wind eddies and sand drift which set the stone in motion, and it may even be a case of sand waves settling to the leeward of the stones in such a form that it resembles the track the stone would make if it were rolled forward.

Our night in the wadi was disturbed by a shot which one of the men sent after a wolf that was in the act of making off with one of our water-skins; luckily one that had been practically emptied that evening. The soldiers, who were already getting anxious as we approached the area within reach of the raiding Awamir, turned out like disturbed hornets, loading their rifles as they went to meet the expected attack. Next morning the footmarks of the wolf were plainly traceable. He had doubtless smelt our one remaining full water-skin from afar, and, the need being urgent, he had taken the risk of passing into the sleeping camp. One of the soldiers had placed the skin for safety between himself and me, and, although the footmarks came within a few feet of us, the beast's courage had failed.

Late in the afternoon of February 16, after a ten hours' march, we came to the end of the monotonous plain and looked over a large saucer-shaped depression, some 20 miles across. Numerous chalky sandstone hog's-back hills were scattered here and there, behind one of which, about 12 miles away but out of sight in the lower part of the basin, lay the palm trees of Jabrin. The descent down the slope was steep, and we were taken east of our course where the gradient was easier for the camels. This, the northern bounds of the Jabrin basin, is called Jabal Aqula (camel-thorn hills), a series of broken mounds of rubble and occasional sandstone ranges. A halt for the night was called in a bushy patch with a few acacia trees (*Acacia flava:* Arabic salam) some 20 feet high. There was a ruined castle on an elevated mound, obviously an outpost of the old inhabitants of the oasis. The Government officials of Hufuf date the last occupation of the buildings of Jabrin at 600 years ago, and I have never heard or read any other views on the subject. The castle was built of large square unbaked bricks, mud mixed with straw, each brick about 5 by 10 by 4 inches, and the name of the castle known to the Al Murra is Qasr Mishash al Aqula. I could find no inscription, distinctive pottery, or, in fact, anything to throw any light on these mysterious people of a bygone age. They seem to have gone and left no record or history.

On February 17 we covered the remaining distance to Jabrin at a more comfortable pace. It had been arranged by the Sultan that one

of the soldiers and Saleh, the Al Murra, were to go ahead of me and break the news to Hamad ibn Maradvath, Shaikh of the Jabir branch of Al Murra, and my prospective host. It had not been possible to communicate with him before, and as he had but recently joined the fanatical sect of Islam called the Ikhwan, the Sultan was not able to foretell how he would receive the shock when he heard that an infidel was to be his honoured guest. I had promised to wait beyond the horizon until the excitement had abated. We filled in the time hunting hares among some bushy dunes, a chase in which a wild eagle joined in much the same way as a trained falcon, as soon as we had moved the quarry into the open. Eventually Saleh arrived with a favourable message from the Shaikh.

There is one well of good water which counts at Jabrin, lying a mile outside the date palms that stretch away to the south, a black patch in a frame of white chalky sandstone and sand desert. Round the well are clustered the tents of the Al Murra, and there is one small masonry building resembling a dust-bin, the pride of the whole tribe; on this account the place is dignified by the name of the Dira (or town). Like all Badawi, they prefer to live in their black woollen tents. We pitched our tent near the well on the opposite side.

Shaikh Hamad, who, in addition to his tribal position as paramount Shaikh, has recently been appointed Amir of Jabrin by the Sultan, came to call. His features were regular but small. The dark eyes rather close together, thin lips supposed to be associated with cruelty, complexion not much darker than a sun-tanned European, and a black uncut beard, made up a whole that was nevertheless handsome, and he wore the white head-dress of the Ikhwan. He was coldly polite and gave me to understand that, as the Sultan had asked him to receive me, I should be treated with all honour, but he implied that had I not come with his recommendation it would have been otherwise. He related the story of the recent raids on his people by the tribes from over the border, and requested me to inform him where I wanted to go each day, that he might send armed and mounted men to encircle the area in advance to avoid any chance of an ambush, and he asked me not to start until they returned and reported all clear.

In the evening a feast arrived with a whole goat on a pile of steaming rice. As we had been living on nothing but boiled rice and dates for the last ten days, I was really glad to have the prospect of a square meal; nevertheless I reproached my soldiers for allowing the Amir to put himself to so much trouble. They said the Amir had wanted to follow the Badawi custom and cook a young camel, and, knowing my wish to avoid entertainment and ceremony, they had compromised with a goat, and thought they had merited praise rather than blame. The Amir joined me to drink coffee after the meal, and said most of the tribe with their camels were in their northern grazing near Juda, between Riyadh and Hufuf. Heavy rains had fallen there during the autumn, and food was

plentiful. In May they might be expected to come to Jabrin, where they would stay about three months, until the dates were gathered, before wandering north again. The tribe never camp within the palm groves, which have an evil reputation for fever, and the dread of the spirits that are said to haunt the ruined forts there is an additional inducement to camping outside.

Saleh told me much more of the Al Rimal, in which the Al Murra roam as far as Magainma in the centre of the Great Sands, and about 120 miles south of Jabrin. The name has a strange resemblance to the Magan of ancient Sumerian inscriptions, which L. W. King, in 'A History of Sumer and Akkad,' suggests is possibly either in Sinai or a portion of Eastern Arabia. The late George Smith, of the Department of Oriental Antiquities, British Museum, has translated the Sumerian name as Maganna, and here the resemblance between that and the Arab pronunciation of Magainma is even more remarkable. He says,* "Sargon was succeeded by his son Naram-Sin, who conquered the kingdom of Apirak and later on the land of Maganna, or the 'ship Region.' This name Maganna, is also applied to Egypt in later times, but it is more probable that the Maganna of Naram-Sin was a region of the Persian Gulf."

Only in years of exceptional rains can the grazing round Magainma be utilized, when water is found in very deep wells—dug, according to Saleh's information, by the Beni Hallal, a mythical people living in prehistoric times. From the position indicated for these wells, which were estimated to be 150–200 feet deep, they might be dependent on floods in the Wadi Dawasir for their erratic supply. In dry years the tribe has perforce to be based on the Jabrin wells, and excursions of five or six days' duration are made around them by the grazing herds. He knew men of his tribe who had crossed the southern sands to Nejran—that is obliquely—which was estimated as a month's journey from Jabrin. The intervening country was mostly sand-dunes, but there were also gravel plains like those we had recently passed. I could hear of no one who had crossed to Aden or the Hadhramaut, which would be through the centre of the desert, but obliquely and eastward to Oman in the hinterland of Muscat is not considered a serious undertaking, as there are wells scattered along the route. The palm area of Jabrin, which, after the well-tended gardens of Hufuf, made a depressing and sorry spectacle, was about 8 miles north to south, and 3 east to west, a wilderness of neglected trees struggling in an unequal contest against the desiccation that is overpowering them. The wells, which we had been told were running streams like those in the Hasa, were shallow waterholes with still water 3 feet below the surface, with shelving sides at which the camels can drink with ease. No attempt is made to irrigate the palms,

* "History of Babylonia," by the late George Smith, in 'Ancient History from the Monuments,' Rev. A. H. Sayce, p. 80.

which have to obtain water as best they can from the subsoil, and there was no evidence of ancient irrigation channels. Between the patches of palms were small dunes of soft decayed limestone, which the smallest wind sent across the so-called gardens in a blinding powder. Some of the trees, in spite of this, were coming into bloom, and the Amir and his men were nearly distracted at the thought of the artificial fertilization which they were to undertake for the first time, probably under pressure from Ibn Saud. The true Badawi, who understands only camel rearing and camel thieving, collapses helplessly when faced with any task suggesting, ever so vaguely, a settled occupation, and persuading them to plough or take up any other form of agriculture is as hopeful as teaching a cat to swim. The northern end of the oasis contains several ruined castles with mud walls, and also the best of the date trees.

Towards the southern end water becomes scarcer and the palms gradually diminish. Many are already dead and stand like tattered masts in a harbour till they rot or are blown down. We came upon many holes there where the subsoil has subsided in circular pits. The Arabs call them Zawarit, and say that they take a heavy toll of the camels, as the clumsy beasts get into them and are sucked down before assistance arrives.

Seated on one of the hills to the south of the oasis, Jabal Jabrin al Wasti, our Saleh, once more in talkative mood, spoke of the Al Rimal, now lying for some 600 miles to our south, and of other parts of the 100,000 square miles of desert that he and his tribe call home. Al Rimal immediately joins the sandstone of the Jabrin basin. To the eastward lies the group of wells called Bir Aziz in the middle of the sands; it is nevertheless considered the boundary between Al Rimal and Jafura deserts. The Jafura, which is all sand-dune country, runs north to Aaj, which is close to and just to the west of Salwa. On the west of Jabrin, Al Rimal runs northward to join the sands of the Dahana, the boundary being somewhere to the south-eastward of Riyadh. I asked him if he knew Al Khiran, mentioned by Philby; he had only heard of it, as it was the southern grazing ground of a different branch of the Al Murra. He pointed to it as being south-east of Jabrin, but said no one ever reached it direct from Jabrin. The tribes always went there direct from the Hasa, from which it was ten days by camel. As far as he knew, there were no wells there, but only pools of brackish water. I could find no confirmation of a ruined town in the sands of the Jafura, but there is a well-known but vague tradition that the remains of the city of Ibn Shaddad lie buried somewhere in the far south.

On the evening of February 20 there was a total eclipse of the moon. The clear atmosphere made it a magnificent spectacle. As soon as the shadow was noticed the laughter and chink of coffee-cups at my camp fire ceased, and although the evening prayer was but recently ended, the party betook themselves hastily to the Al Murra camp, where the voice

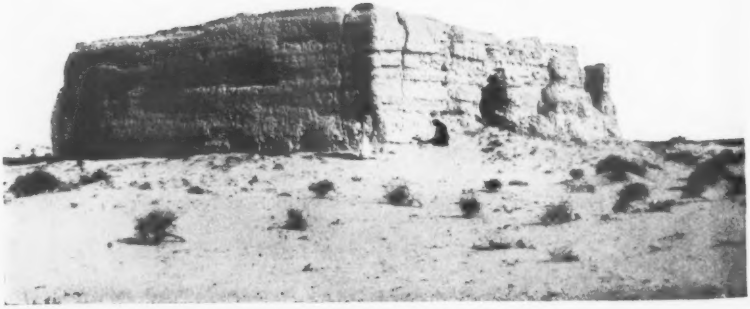
SARAMID

SAND-DUNES, JAFURA

OASIS OF JABRIN

SOUTHERN JABRIN

WATER-HOLE, JABRIN OASIS



QASR TAWAIRIF, JABRIN

of the Amir and the responses of the congregation were once more raised in supplication to Allah that the moon would come out again. As the period of totality alone lasted an hour, the newly appointed clerk in holy orders must have found his resources severely taxed, but he was eventually successful, for the moon reappeared and my soldiers gathered once more at our fire.

On February 23 we left Jabrin, following much the same route by which we had come. The first night was spent among soft sand-dunes on the slopes of Jabal Aqula with the express purpose of trapping some gerbils whose earths had been marked on the journey down. They proved a new species of *meriones* remarkable for the pale straw colouring, which exactly resembled the sand. The following morning the first jerboa was dug out and caught. They stop up the entrance of their hole with sand from inside, so there is little to attract attention. The tunnel is about 10 yards long, and the back end is left just below the surface. When an enemy begins digging the jerboa opens out the emergency exit and takes to flight, usually unobserved, leaving his foe busy with the excavation. The first act in a jerboa hunt is, therefore, to find and bar the second door.

At the top of Jabal Aqula we crossed the tracks of twenty-four camels, which Saleh examined closely and pronounced to be a raiding party of Awamir. He said they had passed over our previous footprints about twenty-four hours after us, and as this was in view of our camping ground the night before we entered Jabrin, they would certainly have made an attempt to get our camels had we been one day later than we were. As there was no sign of their returning tracks, the men had little sleep for the next few nights and were very jumpy. The mere fact of all the camels looking in one direction as they lay in the camp was enough to send them all out with their arms. Luckily I had done sufficient star work on the first journey to fix positions, as they would certainly have vetoed any lamps or electric torch, and I was barely allowed sufficient light to enter up the day's notes before the order for " Lights out " was respectfully whispered in my ear as the last daylight faded.

Camps were pitched every night in the trough of dunes as before. On February 26 the south wind, which had been blowing all day, dropped, and at the same time during the short interval we could hear the north wind approaching over the dunes, all around being in perfect silence. With the north wind appeared a plague of small moths (*Hetenographis fulvimarginella*), that swarmed round my lamp, and, crawling into the smallest air-holes, gained the flame and eventually succeeded in extinguishing the light.

The north is apparently the prevailing wind, as most dunes run eastward and westward and are " steep to " on the south. We had a driving sand-storm in our faces for the next few days. The heavier stuff blowing in a thin film up the windward slope fell short on the other to form the

steep soft bank. On a camel one is above the worst of it, but your eyes, nose, and ears nevertheless get full of the fine blown particles, and the Arab head-dress or kafiya well tucked round is the only efficient protection.

On February 27 we made a forced march of about twelve hours' hard going, covering $37\frac{1}{2}$ miles, and camped by Zarnuqa well after dark, as our water was almost exhausted. The two first camels to arrive had twenty-five of my canvas bucketfuls between them, which would be about 9 gallons each. They were all feeling the effects of the long marches, and were daily travelling slower and slower, and we had to leave one man behind to follow slowly on one of the beasts that could not keep up. The usual day's march by Badawi is eight hours, followed by four hours' rest while the camel feeds, when the eight hours and four hours are repeated, so that sixteen hours out of the twenty-four are spent in travelling. Our best days' travelling with camels walking over gravel plain were 37·5 miles at 3·6 miles per hour; 35 miles at 3·6 miles per hour; and 29 miles over 3·4 miles per hour. These averages are calculated to corrected distances on the map, so we can confidently say that 3·5 miles per hour is a good estimate for a caravan in which the going is level and there is no trotting. The fastest camel journey during my sojourn in Arabia was 13 miles at 6 miles per hour, camels trotting about a quarter of the distance on level road. The next fastest was 37·5 miles at 3·9 miles per hour; this was usually over sand-dunes, but camels trotted over any level stretches, say one-eighth of the way.

The next day at Zarnuqa Well was spent in camp. We were all glad of a rest; I felt I could not go another day without a wash, and arrears of notes and skinning had, during the last few days, been accumulating.

The cliffs of Jabal Kharma Zarnuqa lay between us and Hufuf, and the remaining distance was split up into two easy stages to enable a leisurely examination to be made. The chalky sandstone of these hills is similar to the rest of Hasa outcrop, and we found the same birds, adding one—a Long-legged Buzzard—which had a nest on a ledge. On March 1 we had to pass Jabal Arba, and, on climbing to the top, a fine view of the Hasa oasis is unfolded about 12 miles to the north. The opportunity was taken to get cross-bearings on the hills that were needed to check my previous map.

We entered Hufuf at midday. To our surprise we learned that not only the Sultan but the Governor, Shaikh Abdullah, had both been hurriedly called away to attend to some political trouble brewing up in the north. The Governor's son, Fahad, was acting Governor and received me. He said the Sultan had left at short notice and had given him no instructions about me, and there was no way of communicating with him and getting a reply under two months, by which time he expected him back, and I was welcome to wait in Hufuf until his return. But my time had already expired, and I had no choice but to depart

for the coast as soon as possible, leaving my thanks to my kind host with his deputy until his return. As I was mounting the camel on March 4, a handsome bay Arab stallion was brought to me, a present from the Sultan's stable.

At 'Oqair a short visit was made to the ruin field at Abu Zahmul, and the coin and pottery already mentioned were picked up, and on March 6 we sailed out of the harbour, heading for Bahrein.

My collections resulted thus :

The 48 specimens of Mammals represent 18 species, of which 5 species and 4 sub-species are new.

The 127 specimens of Birds contain 34 species, of which 3 sub-species are new.

The 22 specimens of Reptiles represent 11 species, of which 3 have not been previously recorded from Arabia.

The 20 adult and 17 immature specimens of Fish include 1 species.

The 73 specimens of Insects represent 35 species, of which 4 species and 1 sub-species are new.

The 36 specimens of Plants represent 23 indigenous and 13 cultivated. Two of the indigenous species, an orchid and a water-fern, are new to the Arabian List.

Twenty-three geological specimens were obtained from Hufuf, Jafura, Wadi Sahba, and Jabrin.

The types of all new species and sub-species have been presented to the British Museum (Natural History).

Among the specimens I have to show to-night are the pale cream-coloured desert lark (*Ammomanes deserti azizi*), with pieces of the creamy white sandstone of the Hufuf hills among which it resides. An almost black race of the same species of desert lark (*A. deserti annæ*) is that exhibited by Colonel Meinertzhagen, which was obtained by him in a black lava belt in the Syrian desert; in the same box are examples of the dark lava.

The pale creamy-coloured desert eagle owl, hare, jerboa and gerbil from Hasa and Jabrin are shown beside their dark relatives and neighbours from 'Iraq, Oman, Aden, and Yaman, also a pale pipistrelle bat from Hufuf with a dark pipistrelle from Basra, and a male and female fish (*Cyprinodon dispar*) from the hot springs of Hufuf.

The geological collection is represented by etched pebbles and other stones polished by sandblast from the Saramid and Sahba gravel plains; water-worn pebbles and conglomerate from the bed of Wadi Sahba, and the "walking" stone from the same region.

The occurrence of any species in a new country is of interest from a point of view of distribution. Students of the question of colour in direct relation to environment will find strong evidence of the influence of local colour on this fauna. All specimens of resident birds and mammals in the true desert have desert colouring in a remarkable degree, especially

a new desert lark (*ammomanes*) and a new gerbil (*meriones*), which are of a beautiful pale straw colour exactly resembling the sands around them. Their allies and neighbours in Muscat, 'Iraq, and Southern Arabia, where there are dark rocky hills and more vegetation, have fur and feather grading to dark brown. Passing over the Yemen and Hejaz mountains and the dark forms occurring there, we meet again the desert colouring and a very similar type of fauna in the deserts of Somaliland, Sudan, and Sahara ; but, strangely enough, it is not until we come to comparisons with Buchanan's collection of birds and animals from Aïr, in the western or farthest Sahara, that we have been able to find in some cases the shades of colour prevailing in Hufuf and Jabrin.

The animals and birds are not a collection made by me in Arabia. Only the palest are my Arabian specimens. These series are arranged to show what is meant by desert colouring, and beside the palest forms from the true desert are laid their darker relatives and neighbours from dark rocky districts or places with more vegetation. We are fortunate in having two remarkable examples of desert larks (*Ammomanes*), one dark and one pale, and in both cases we have specimens of the rocks in which they live. Colonel Meinertzhagen has very kindly brought a specimen of his species which he found inhabiting a comparatively narrow strip of black lava running through the Syrian desert, and this desert lark is nearly black. This dark species cannot be induced to leave the dark lava and fly out on to the pale desert. On the pale desert a pale species of the same lark is found. I want you to compare Colonel Meinertzhagen's dark bird and the lumps of lava with my pale desert lark from Hufuf and the lumps of white chalky sandstone among which it lives. Colonel Meinertzhagen has also brought a finch which lives on the rocks of Petra, and he also has a piece of Petra to illustrate the remarkable resemblance between the bird colour and that of the rock. You will note the strikingly beautiful pale eagle owl from the white crags of Hufuf and the dark species from 'Iraq's dark mountains, its neighbour. This pale desert colour runs through the animals and insects as well, but I have not brought any insects. You will see the pale desert hare from Jabrin beside its darker neighbours from Oman and from 'Iraq.

The Jabrin jerboa is pale and the 'Iraq representative is dark, and there is also beside them a pale desert example from the African Sahara. The desert bats even show this pale coloration, and perhaps the pale gerbil with the dark forms from Aden is as marked as any.

The fish which is able to live in water which is almost hot enough to cook it is also shown. To those who are interested in desert problems, I would recommend the peculiar fluted surfaces of some of the pebbles, and others beautifully polished by sand blast. There is also a bit of conglomerate from the original bed of the Wadi Sahba and the walking stone.

Mr. H. St. J. B. Philby has kindly assisted in arriving at the correct spellings of new place-names in this paper and on the map, according to the rules of the P.C.G.N.

Before the paper the PRESIDENT (the EARL OF RONALDSHAY) said: Our lecturer to-night is not unknown to the readers of the *Geographical Journal*, for he has already given us a description in that *Journal* of one of his journeys in Arabia undertaken some time ago, largely, I believe, for the purpose of discovering an ancient Phœnician city on the southern shore of the Persian Gulf, the city of Gerra. On that occasion he was not successful in discovering the site of the city, but in a more recent journey undertaken last winter a greater measure of success was achieved, for he came, quite by accident I believe, upon its ruins at a time when he was looking for something else. That, however, was not the object of the journey. The journey which he is to describe to us to-night was undertaken mainly for the purpose of investigating the migrations of birds from the heart of Asia across Arabia to more southern regions, and to examine the other fauna of the Arabian desert. In the course of his journey he was successful in carrying through some very valuable geographical work. If you look at the map of Southern Arabia you will find little more than a blank space which is usually coloured yellow, the intention of the map-makers being, I suppose, to indicate that that part of the world consists mostly of yellow sand; and that, indeed, is the case, for the desert into which Major Cheesman penetrated covers an area of something like half a million square miles. He penetrated some distance into this amazing tract of country and covered a good many miles upon which no European foot, so far as we know, had ever been set before. The ultimate point of his journey, the oasis of Jabrin, had never been visited by a European before Major Cheesman arrived there last winter. He will certainly have a great deal of interest to tell us, and since besides being a successful naturalist he has also proved himself a good photographer, with a very good pictorial record of the country through which he passed. I now have much pleasure in calling upon Major Cheesman to give us his account.

Major Cheesman then read the paper printed above, and a discussion followed.

The PRESIDENT: We have present with us to-night Lord Rothschild, who followed the journey of the lecturer with the keen eye of the naturalist. I am sure you would like to hear a word or two from him.

Lord ROTHSCHILD: I must ask you to excuse me in so far as I am unable to say anything with regard to the wonderful journey of Major Cheesman either from the geographical point of view or from the point of view of the actual dangers and difficulties of the journey. But I am well acquainted with portions of the Sahara and of Algeria, and I should like to say that the discoveries in connection with animal and bird life are most interesting to one who has, to a small extent, studied their coloration from an evolutionary point of view. It is very strange that the pale desert eagle owl, which only finds a parallel coloration in the central Sahara and at Aïr, should be quite different in the adaptation of coloration to the desert lark in that the *Ammomanes* at Aïr, though not as black as that discovered by Colonel Meinertzhagen, is quite dark, though in the same country as that in which the desert owl is found in Arabia it is quite pale. There are several reasons for this, and the question of the hare illustrates the point very well, because in Algeria you find in the cultivated ground and on the steppe a rather dark-coloured hare, whilst all through the southern part of Algeria and the north Saharan desert you find a greyish sandy-coloured

hare which resembles the soil; while in the central Sahara the hare (*Lepus whitakeri*) is reddish sand colour. At Ain Sefra, in western Algeria, which is really a portion of the central part of Algeria, of the Haut Plateau region, there has drifted in from the desert a very large mass of sand-dunes, and with them have come the pale desert-coloured birds; but the hare, although it is not as dark as that of the coastal Algerian form, is still a dark-coloured hare. This proves that the sand-dunes which render it practically a part of the desert have only recently invaded Ain Sefra. It is the same, I think, with the birds and animals: that those which have more recently come into the desert districts have not yet adopted such a pale coloration, but you find very curious developments of coloration which show that the desert has a direct effect on the bird. In the neighbourhood of Biskra in Algeria there are desert larks of a greyish clayey colour, because the desert there is more grey in colour than where there are large masses of sand-dunes. But about 30 miles south of Biskra in the midst of the clayey desert there are small islets, some only a few hundred yards across, others perhaps more than a mile, which are composed of yellowish gravel and sand mixed. In those is found a desert lark which is quite yellowish in colour, like the soil, whereas in the grey clayey district a lark is grey like the soil. The peculiar part of the matter is this: that these yellowish birds are only found on these little islets during the breeding season; in the non-breeding season they are flying about in flocks together with the grey birds. The eagle owls are most interesting, because they show great variations in colour over a very large area. The eagle owl, of which these pale birds are local races, goes from Norway down to the southern edge of the Sahara, from north to south, and from Spain into China, from west to east. Of the yellow desert form, which is known as Savigny's eagle owl, *Bubo bubo ascalaphus*, the darkest occurs in Tangier and the neighbourhood of Azasga in Algeria, whereas the lightest form occurs in Arabia and the Central Sahara. There are in Central Asia birds which are as large and marked in the same manner as the European and Russian eagle owls, but which begin to show the desert trait. There is one from 'Iraq, and there is also in the Gobi Desert and in Central Asia a form *Bubo bubo turcestanicus*, which although it is marked the same as the great Norwegian eagle owl, is of a much more sandy colour, whereas up in Siberia the ground colour changes to white. The little gerbille (*Dipodillus campestris*) also is found varying with the soil; in north Algeria it is brownish-grey; in Bishira it is sandy-grey; while in the Central Sahara it is rufous sand colour.

Major Cheesman has shown a picture of two parasitic plants. These occur also in the Saharan desert. The one on the left of the picture, the *Phelippæa*, is parasitic on the tamarisk. Wherever tamarisk bushes grow this curious parasitic plant is to be found. With regard to the sulphur well, of which a picture was also shown, those curious domed houses standing near it are found also in the Sahara, especially at a place called El Wad, halfway between Tuggurt and the Tunisian frontier, and there the whole town of many hundreds of houses is built exactly in the same manner.

The PRESIDENT: It was through the influence of Sir Percy Cox that Major Cheesman was able to undertake this journey, and I should be glad if Sir Percy Cox would speak.

Sir PERCY COX: I have never actually travelled in that part of the Arabian Peninsula to which Major Cheesman went on this occasion, so I cannot add much to the geographical discussion, but I am glad of the opportunity of being able to make a few observations. In the first place, I should like to thank the lecturer for his appreciative reference to my encouragement

or co-operation. I need hardly say that it was given entirely *con amore*, and my only regret was that I could not go with him. Politics between 'Iraq and Central Arabia at that time did not allow of it. I remember the last occasion on which I stood here was that of a lecture by another friend of mine on a journey in the Caspian Provinces of Northern Persia, and after the paper I ventured to complain that the lecturer had brought back no information with regard to the fauna. Our President caught me up on that point and reminded us that the lecturer had referred to the fauna; that he had spoken feelingly about the human parasites that he had come in contact with! On this occasion I have no complaints to make; Major Cheesman has had a good deal to say about the fauna, which has been very interesting to me. As regards his destination—Jabrin. For the last twenty years I have been in touch with the Arabian coast and parts of the interior, and Jabrin has always been a sort of mystery city with all the Arabs with whom I have come in contact. And you see how intensely Badawi exaggerate when they speak of anything in the shape of an oasis in the awful deserts over which they roam and spend their existence. From what you hear you would imagine that Jabrin was a delightful Eldorado, but it is a terrible-looking place judging from the photographs we have seen to-night. That is the reason; it is such an abnormal thing that when they find a green patch they make the most of it when talking of it to their friends who have not been there. Then Major Cheesman spoke of the music of the sands. Lord Curzon, in his 'Tales of Travel,' has given a complete *résumé* of the literature on that subject. I was not aware until I read his book that there was so much. I have two or three times met with it in the sand-dunes in the Nefud between the Trucial Coast of Oman and Abu Dhabi. The sounds differ greatly. What I heard was just like an organ in the distance, a regular booming. The caravan was passing up and down the big sand-dunes, disturbing the sand, and, though sometimes there was not much wind, it evidently was the action of the wind on the sand which produced these noises. What Major Cheesman heard was the "musical beach," which is quite a different and much smaller sound.

I am very glad, as a lover of Palgrave's book, to find that as the result of his journey the lecturer has been able to tilt a lance on behalf of Palgrave. I like to think of him as the rather picturesque writer, as Major Cheesman described him, when he gave his conception of the difference between Palgrave as an explorer and Mr. Philby: the one extremely accurate and precise and the other remembering in a rather impressionist way what he had seen and describing it in picturesque language.

The lecturer referred to the term Ruba Al Khali as applied to the Arabian desert. I also found on the Oman side and all the way up to Kuwait that no one understood the term at all. When you spoke of Ruba Al Khali you had to explain what you meant. In the south they only speak of the Nefud or sand-dunes, and where the lecturer was they speak of Al Rimal—the sands. Where the expression Ruba Al Khali came from, I cannot say. Perhaps Dr. Hogarth will be able to tell us.

As regards Major Cheesman as an explorer, he is very well equipped now with the knowledge he has gained of surveying and the needs of geographical exploration, combined with his very complete qualifications from an agricultural and natural history point of view. There are great possibilities for a man with those qualifications, and I very much hope that now he has won his spurs he will find further opportunities of pursuing exploration in some useful direction.

The PRESIDENT: I think we should like to have a final word from our expert upon this part of the world—Dr. Hogarth.

Dr. D. C. HOGARTH: I do not stand before you as an expert on this particular part of the world, nor can I, in answer to Sir Percy Cox's invitation, say where the phrase "Ruba al-Khali," which has become so firmly fixed on our maps, has come from; certainly not from the south-western end, the Yemen end. There they say "Ahqaf" for the sands. The term "Al Rimal" I have heard before. I do not know how Ruba al-Khali has come; but I have noticed that Mr. Philby never questions it. Whether he actually heard it when he went to Dawasir, I cannot say.

Major Cheesman is to be congratulated on having made a very distinct contribution to the solution of the problems of that desert and the question of the possibility of crossing it; though I agree with Sir Percy Cox that Jabrin, now that we have found it, is not in the least the Jabrin of our dreams, or likely to help the crossing of the desert. It is always difficult to realize relative position until you see a large map. I do not think I had ever realized that Jabrin lay so far to the north; and that you can really get nearer to the heart of the desert by going to Laila and Wadi Dawasir than by going to Jabrin. If any definite attempt is made by a European—and such an attempt is in prospect or, at least, under consideration—it will probably be made from a point further towards the south-west. At the same time it is very interesting to know what Jabrin is like. I certainly had never realized that it is a limestone patch deeply embedded in desert, and with two rather narrow strips of desert on each side.

So much for geography. But Major Cheesman makes other contributions. Lord Rothschild has spoken of his very remarkable addition to our knowledge of the fauna, and particularly of the birds. There is also archæology. In regard to the Gerra question, I like to believe Major Cheesman has found that ancient city, and until good reason is shown I shall continue so to believe. Ancient names in primitive countries are so apt to cling to a locality, if not actually to a site, that, considering the close phonetic resemblance between "Gerra" and "Ajer" (the place where Major Cheesman landed), and the paucity of possible ports in equally favoured situations on the Persian Gulf, it is extremely likely that the large ruin-field within a mile of Ajer is actually the site.

Then there is anthropology. There seem to be a great many things to be done even in so barren a country as Arabia, and one thing is to go and study the human beings as well as the fauna. The difficulty is that you cannot exactly trap and shoot human beings without turning a hair, and they are only too likely to begin doing the shooting and trapping first. At the same time some attempt should be made by a scientific expedition to examine the people who live round the eastern end of the great desert and are, probably, pre-Semitic. The Al Murra seem, in any case, to be early, and it is not in the least surprising that Saleh, Major Cheesman's servant, should show features which recall Sumerian monuments, because it appears that the Mesopotamian population has all come up, wave after wave, out of Arabia, and the ultimate residuum of the peoples from which those waves started should still be found in the not very desirable regions of the extreme south-east and south.

Finally, I should like to echo another thing that Sir Percy Cox has said. I also have tried more than once to break a lance in favour of Palgrave—not that I really approve of him! Mr. Philby's strongly developed scientific conscience has, I think, always been a little hard on Palgrave. It is, perhaps, impossible for Mr. Philby to understand a man who will write about what he

is conscious that he does not know exactly. That is what Palgrave did. There are various types of conscience, the scientific conscience, the nonconformist, and so on! Mr. Philby has the scientific in a highly developed form. Palgrave certainly had not. But he was not a downright liar. There is a great difference between the attitude of a downright liar and that of a man writing loosely about details which he does not very well remember. Palgrave had lost his notes in a shipwreck. But I do not fancy they would have been of very great value to him, when, arrived back in this country, he found he was expected to remember geographical matters to which he had given little attention on the spot. But, in any case, he was the kind of man who puts down as much as he can remember and then fills in more or less picturesque detail which, so far as he knows, may be right, reflecting that nobody else will be in a position to say it is wrong. The main facts Palgrave must certainly have remembered, and it is, I think, absurd to suppose that he invented visits to whole districts and fabricated long journeys; for example, his journey to the oasis of Hasa. Major Cheesman has borne witness that he had a good memory for general impressions. He went out, not for exploration, but on a secret anti-British mission from Napoleon III., and when he came back and found that he was expected to redeem his credit here by giving useful information about geography, he found himself in very considerable difficulty. He had paid no particular attention to the matter on the spot; and we all know how difficult it is, after a long journey and the sight of a great deal of country, to remember details. When you see the paper in its printed form, and read what has been omitted in Major Cheesman's speech to-night, you will agree that he has produced convincing proof that Palgrave actually went to Hasa and did, as a matter of fact, give a very good impressionist account of it. I congratulate Major Cheesman on a thoroughly satisfactory paper, full of different topics of great interest, and confined from first to last to things really seen and known.

The PRESIDENT: After what you have heard to-night you will have perceived how well justified your Council were in equipping Major Cheesman with geographical instruments. He has made the most excellent use of them and brought back a great deal of information which will assist in filling up the blanks in the map of Arabia. Not only that, but he has returned the instruments as well—a thing we cannot always say of all those explorers whom we have equipped! He has given us this evening a narrative of a most interesting journey, full of information, lit with delightful touches of humour that have really thrown a flood of light upon a very little-known corner of the world. In offering to Major Cheesman the grateful thanks of this audience for the evening which he has given us, I would venture to add the hope that this will not be the last of his encroachments upon the unknown quarters of the globe.

IRRIGATION IN THE INDO-GANGETIC PLAIN

A. V. Williamson, B.A., Assistant Lecturer in Geography, University of Leeds

Read at the Afternoon Meeting of the Society, 8 December 1924.

THE Indo-Gangetic plain covers an area of 300,000 square miles, and embraces most of Sind, northern Rajputana, the whole of the Punjab, United Provinces, Bengal, and half of Assam. Throughout this region the late summer and autumn—the period of the south-west

monsoon—is the season of heavy rainfall, but in parts economic importance attaches also to the winter rains. The plain is influenced by both branches of the monsoon, but the eastern or Bay of Bengal branch brings practically all the rain received. Only at rare intervals does the western or Arabian Sea branch penetrate eastwards beyond the line of the Jumna River to affect the Ganges valley. North of the Gulf of Cambay it is no longer moisture laden, for in these latitudes the reservoir of air-supply is the heated plateaux of Iran and Baluchistan; any moisture which the wind picks up in traversing the narrow sea *en route* to its goal in the barometric minimum over Sind is lost to the coastal fringe, and contact with the heated sands of the Indus basin only renders it increasingly desiccating.* Bikanir, with a monsoonal rainfall of 9·1 inches, is typical of the intense aridity prevailing throughout Sind, western Rajputana, and the western Punjab.† Over the eastern half of the plain rainfall decreases as one moves inland from the Ganges delta along a line parallel to the Himalaya (*i.e.* from east to west through Bengal and the United Provinces, then from south-east to north-west through the Punjab) and also from the mountain foot out over the plain. Thus :—

	Annual rainfall (inches).	*Monsoon rainfall (inches).*
(*A*) *E. to W. up the Ganges.*		
Calcutta . . .	62·7	50·8
Fyzabad . . .	43·6	40·2
Delhi . . .	27·4	23·5
Moving out over the plain across the Ganges Valley.		
Pilibhit . . .	53·4	48·4
Fyzabad . . .	43·6	40·2
Allahabad . . .	38·3	35·6
(*B*) *S.E. to N.W. through the Punjab.*		
Delhi . . .	27·4	23·5
Lahore . . .	19·7	15·1
Peshawar . . .	13·6	4·8
Moving out over the plain.		
Simla . . .	65·7	49·7
Sialkot . . .	31·0	23·0
Lahore . . .	19·7	15·1
Multan . . .	6·6	4·6

The winter rains though small in absolute amount are of great importance in connection with the rabi (spring) crops of northern India. From the

* This statement is adequate for our purpose, but see also Dr. G. Simpson, *Q. J. Met. Soc.*, vol. 47, July 1921, p. 168.

† Unless otherwise stated, rainfall figures given throughout have been computed from records extending over a period of forty-five years. Rainfall occurring during late September and October anywhere in India is most accurately described as belonging to the retreat of the monsoon. It is, however, only in peninsular India that the rainfall of the retreating monsoon acquires a distinctive character from an agricultural point of view. For us, therefore, the south-west monsoon embraces June to October inclusive.

centre of maximum precipitation in Peshawar—which receives over half its annual rainfall of 13·6 inches between December and April—the fall dwindles and the season shrinks as one moves towards the south, and although some rain occurs throughout the United Provinces during this period it is scanty away from the hills and far less reliable than further north. In the eastern half of these provinces it blends early in the year with the spring storms rainfall, which belongs to an entirely different order of natural phenomena and is of little agricultural importance outside the rice country of Bengal.

The extent to which precipitation over any tract is liable to deviate from the normal seasonal average may be held to determine its economic value. This is equally true whether the variation is positive or negative since a drowned crop spells failure just as much as a parched one. The character of the rainfall—whether heavy or light—its actual distribution in time, retardation of the rainy season or a premature cessation, are all factors which modify the value and require recognition in the study of conditions prevailing in any particular season or the agricultural history of a small tract. In general, the lower the rainfall the greater the variability. An analysis of the percentage deviation of rainfall at certain stations throughout India provides ample proof of this. Appended are a few of the results arrived at for the region under discussion based on records covering the period 1896–1915 :

Station.	*Season.*	*Average fall.*	*Per cent. variation.*
Peshawar	S.W. Monsoon	4·8	59·5 per cent.
,,	Winter (Dec.–Apr.)	7·4	37·8 ,,
Bikanir	S.W. Monsoon	9·1	42·8 ,,
Lahore	,,	15·0	38·0 ,,
,,	Winter (Dec.–Mar.)	3·3	36·9 ,,
Delhi	S.W. Monsoon	23·5 (1892–1911)	28·6 ,,
Fyzabad	,,	40·2	22·0 ,,
Calcutta	,,	50·7	16·4 ,,

A variability in excess of 20 per cent. implies great risk in farming. Where rainfall is less than 10 or 12 inches agriculture cannot be carried on save under irrigation, so that there is little attendant risk. Such is the case throughout the arid western half. In lower Bengal and Assam rainfall is both plentiful and reliable, and economic distress need not be apprehended. Elsewhere throughout the plain, embracing the most densely peopled part of India, natural moisture is normally sufficient to ensure the harvest, but such is the degree of uncertainty that in the absence of irrigation agriculture is reduced to a gamble. The history of famine in India is illuminative of the losses sustained.

What then are the facilities offered by nature for the practice of irrigation in this area? The Indo-Gangetic plain, as we know it to-day, is a vast level expanse of fluviatile material which has been accumulating ever since the upheaval of the Tertiary mountain periphery which delimits

it on the north and east. The great rivers to which it owes its creation have continued throughout to work their changeful will over its whole surface, and in many parts a decade is the measure of antiquity. The present main watershed between the Indus and Gangetic systems lies between Saharanapur, Ambala, and Ludhiana. Here the land stands at 900 feet, whence it falls imperceptibly to the deltaic areas at either extremity. The alluvium forms one continuous series throughout, but it is usual to distinguish between the Bhangar or older alluvium containing fossiliferous remains of Pliocene age, and the Khadar or newer alluvium in which occur fossils chiefly of living species.* The Bhangar is generally confined to the higher land lying above the annual flood-level of the rivers, and wherever it has been encroached upon the deposition of Khadar is proceeding. The older alluvium, being well consolidated and reinforced by nodular limestone (Kankar), rarely loses more than 10 feet a year at any point where exposed to river attack, but the newer material immediately adjacent to the rivers often sacrifices 300 or 400 feet in the same time. The hills skirting the plain are everywhere fringed with gravel slopes (Bhabar), in crossing which the rivers lose themselves to reappear in the clay (Terai) below.

The subsoil of the plain consists usually of alternate layers of sand and clay to an unknown depth, and the water-retaining powers are greater or lesser according as one or other predominate. In general it responds admirably to irrigation. There are, however, extensive alkaline tracts—great salt (Reh or Kallar) encrusted areas known in India as Usar land. It has been estimated † that in the United Provinces alone there are three million acres thus infected. The problem of how to reclaim such land has engaged attention for the last forty years, but success is still only in the experimental stage. The relationship existing between irrigation and Usar land is of first importance. The salts can only be brought to the surface when two conditions are present: first, water to percolate down to the subsoil and dissolve them; and, second, a strong evaporative force. Therefore wherever drainage is inadequate or over-irrigation is practised, the first of the required conditions is furnished. In the early days of pioneer irrigation failure to provide adequate drainage caused the land in the neighbourhood of the older canals (Jumna and Ganges) to become waterlogged, with the result that thousands of acres now lie outside the pale of cultivable land. British engineers soon learnt, however, that it is just as important to get water off the land as to get it on, but, as we shall see later, the cultivator has not yet grasped this truth.

The level surface of the plain commanded and traversed by the glacial-fed perennial rivers of the Himalaya offers every facility for the

* "Some Remarks on the Geology of the Gangetic Plain," F. Molony, *Jour. Asiatic Soc. of Bengal*, vol. 1, No. 9, N.S., pp. 231 *et seq.*

† 'Irrigation Works in India,' 1909, p. 277, J. Clibborn (Principal, Roorkee Engineering College).

construction of great canals, in contradistinction to the peninsular division of India, where the broken topography and feeble rivers sunk below the general surface militate against such works. Moreover, the absence of any marked surface irregularity further permits the rain to sink into the ground, while percolation from rivers and canals also contributes to maintain the subsoil water-table at a level which can be readily tapped by wells.

So much has been written concerning the canals of India that there is a tendency to think of irrigation throughout the continent in terms only of these triumphs of engineering skill. It is, therefore, often a surprise to learn that over one-half of the acreage under artificial watering is nourished by small private works of which the principal is that ancient aid to husbandry—the well. Over three-quarters of the area served by this type of work lies in the Indo-Gangetic plain, where, as already noticed, conditions are most favourable. The well reaches its maximum development in the United Provinces, where, with the exception of the rocky district of Bundelkhand, much clay is present, and the subsoil water-table lies close to the surface. Practically one-half of the well-irrigated acreage of India falls within these provinces. On the other hand, in the Punjab clay is often absent and pure sand extends to a great depth, so that wells can seldom be sunk to any advantage far from a river. The chief centres of well-irrigation in this province are Sialkot, Jallandar, Amritsar, and Gujranwala, *i.e.* in the coarse strata near the foothills of the Himalaya.

The importance of the clay in the Indo-Gangetic alluvium cannot be over-estimated. It is known generally as mota in the vernacular, and does not form one continuous layer, but occurs in beds which lie at varying depths, forming, as it were, islands in the sea of sand deposit. The mota acts as a beam to support the well, which is fed with water through a hole 6 to 9 inches in diameter bored through the clay to tap the saturated sand below. Wells constructed on a mota foundation are generically termed "spring wells" in contradistinction to that class of well which depends for its supply upon percolation through the sides and base. The latter type are characteristic of the submontane gravel zone. Wells—whether of the spring or percolation type—may be either phakka (permanent) or kachcha (temporary). The former involves masonry work, and is the chief well in the Punjab, where the great depth of the water-table renders strong walls necessary. The cost of such a well and the area it will irrigate depend upon a number of variable factors, but for the peasant the initial outlay always represents a considerable sum, and only the very fortunate become owners of one.

In the United Provinces, whilst permanent wells play an important part, the height of the subsoil water-level offers greater facilities than in the Punjab for the construction of the kachcha or temporary well. This is simply a hole dug in the ground. Where the mota exists the hole

is dug down to it and then narrowed to pierce the clay. In the absence of such beds the hole is dug to percolation level and then narrowed and lined with brushwood, the water being thus filtered as it passes through. The life of the temporary well is seldom longer than one season. It is essentially the poor man's well, seldom irrigating more than two acres, often only the fraction of an acre. Despite its brief life, however, it possesses several advantages apart from its small cost. Thus the crops requiring irrigation must change from season to season, according to agricultural necessity. When a permanent well is in use this often entails long feeding channels in order to bring the water to the fields, and loss from absorption and evaporation is involved. On the other hand, a temporary well can be placed in close proximity to the crop. Further, a kachcha well can be sunk in a few hours in case of immediate need, and if unsuccessful the loss at most is only one or two rupees expended in labour, whereas a phakka well is a much longer task, and when of the spring type often only satisfactory after several trial borings involving much expense.*

During recent years there has been a great deal of experimental work going on, particularly in peninsular India where wells are frequently of great depth, in connection with the lifting of water. There is no doubt that the native methods of bringing water to the surface, admirable and ingenious though they are, do not extract the maximum possible volume from the well. The old means employed are of various kinds, some involving animal, some simply man power. They persist with slight modifications throughout the East, and require no particular notice, being familiar to most people. The superiority of steam pumps and oil engines over such primitive devices has been amply demonstrated,† but it is admitted that the employment of such modern equipment could only be undertaken with profit on a well yielding 10,000 cubic feet of water per day over the greater part of the year. Expressed in terms of acreage, this means that to justify the application of scientific lifts a holding should be at least 10 acres in extent, and there are few holdings of this size in one block in India. The difficulty could, however, be got over by peasants combining into groups, each of which might possess and operate a large well served by machinery, and in view of the rapid development of co-operative societies in India the suggestion put forward may well prove to be of practical value.

The canals of northern India fall into two groups : (1) Inundation ; (2) Perennial. The former represent the survival of what must have been one of the earliest forms of irrigation, namely, the cutting of more or less shallow channels at right angles to the banks of a river in order that during the flood season a certain quantity might be drawn off to nourish

* "Wells in the Gangetic Alluvium," W. H. Moreland, Direc. Agric., United Provs., *Agric. Journ. India*, vol. 4, part i. 1909, p. 34.

† 'Lift Irrigation,' A. Chatterton, Director of Industries. Madras : 1922,

the land in the vicinity. On the other hand, perennial canals, as their name implies, sustain a constant flow, and involve large engineering works. Geographically the sphere of the two may be distinguished, for the limit of irrigation under an inundation canal is restricted to the lower land, and such canals reach their maximum development where the rivers of the Punjab begin to converge to form the lower Indus and the Khadar widens at the expense of the Bhangar. In Sind it is virtually the only form of irrigation in vogue. The drawbacks of such a system are apparent. Apart from liability to rapid silting, success depends upon the floods rising at the right time and being of adequate volume and duration. Thus it is usual in the Punjab to flood fallow land when the river is up—the area thus treated is normally almost equal to the irrigated land under crops at this season—and to raise wheat on the moisture retained during the winter months.* If the river begins to shrink prematurely the land is not sufficiently saturated and the wheat may fail, or at least it may necessitate restriction of the area sown. Again, if the flood is late (or the volume small), instead of the water overflowing from the canals on to the land by the middle of June, both men and cattle have to be kept employed in lifting it up on to the surface when they should by this time be engaged in the fields. After twenty years of commission and inquiry the Government have finally sanctioned the conversion of the main inundation canals of Sind into a perennial system, and to accomplish this the construction of a barrage across the Indus at Sukkur is now proceeding. What the change may mean in connection with one crop alone is worthy of note. "We consider that the experiments with Egyptian and American cotton in Sind, though they have for the time being ended in failure, show beyond doubt that these varieties can be successfully cultivated in the province. We are emphatically of opinion that the fundamental cause of failure has been the unsatisfactory character of irrigation. Provided a perennial supply of water can be assured we hold the view that there is no other part of India which offers such hopeful prospects of the successful cultivation of long-staple cotton. The climate and soil are in every way most suitable, and all that is wanted is water at the right time and in sufficient quantities." † Schemes for the improvement of the inundation canals of the Punjab have also received sanction.

The essential feature of a perennial canal system is a weir constructed in the bed of a river sufficiently high upstream to ensure that the canal (or canals) taking off from above the headwork can be aligned to command the area to be irrigated.‡ An endeavour is made to find a portion of the

* This practice is far less common in Sind, where 90 per cent. of the irrigation is devoted to Kharif crops. This is probably explained by the fact that the canals of Sind lie in much lower ground and more in soil than those of the Punjab, and hence irrigation has to be carried on by lift to a far greater extent than in the latter province.

† 'Report of the Indian Cotton Committee, 1919,' vol. I, part i. p. 81.

‡ On technical aspects 'Irrigation Works in India,' R. B. Buckley, first published 1905, remains the best single reference in the field.

river where the course is straight, the velocity uniform, and the sectional area of the stream fairly constant. A gorge may recommend itself, since, other things being equal, the narrower the stream the less costly the weir. But at such a point the depth of the river and its velocity may necessitate a particularly stout barrier involving great expense in the long run. On the other hand, a very wide reach must often be avoided because of its liability to silt up, since the velocity of the river is checked when an obstacle is thrown across its path. Further, the tendency of all rivers to alter their course—enhanced by the presence of an obstacle—must be carefully guarded against. This compels a thorough survey of the banks and reinforcement where necessary. The nature of the silt carried must be analysed to ascertain whether it is fertilizing or not, and what portion of it is to be admitted into the canal. Proximity to building stone is another point to be borne in mind.

Throughout the Indo-Gangetic plain the absence of any great irregularity of surface enables the main canal of a system to be brought to the backbone of the doab—the inter-stream watershed—with a minimum of delay and expense, whence lateral branches can be run off. The capacity of all canals and distributaries is determined by the duty * during a period of pressure. This varies of course according to the nature of the crop to be irrigated. The area nourished is naturally limited by the amount of water available, or, if the supply is abundant, by the area which can be commanded under the system. In Madras and Orissa where the supply is usually in excess of the demand little restriction is placed upon the distribution of water, but where, as in northern India, there is need for greater protection owing to a less reliable rainfall, it is customary to limit irrigation to a proportion of the area commanded. Briefly, the available supply is meted out over as large an area as possible in order that each district embraced within the command may have a certain percentage of cultivation assured. This does not promote farming on a commercial basis, but it has the great merit of keeping the maximum number of people above starvation level. These remarks apply particularly to that portion of the United Provinces lying between the Jumna and Ganges rivers. In this densely peopled tract—the hive of Hindustan—protection has been adequate for many years, but the rivers are unable to supply any greater volume, and schemes are now limited to increasing the efficiency of existing works and to assisting ambitious cultivators to sink deep tube wells. There remains, however, a wide field for development north and south of here, particularly in Bundelkhand, which suffers as much from an excessive and ill-distributed rainfall as from drought. When the Indian Irrigation Commission issued its report only one canal existed—the Betwa. The apathy of the Bundela cultivator, the presence of black cotton soil in various parts, and the few facilities offered by the physical features and rivers of the region—which is allied to the peninsula

* Duty = area of crop which can be matured by a given quantity of water.

—were held to explain the situation.* Since this time, however, apart from the three canals, the Ken (1906), the Dhassan (1911), and the Ghaggar (1918), several large tanks rendered possible by the broken nature of the country have been constructed and others are in hand. North of the Ganges, between that river and the submontane zone there is at present no canal, although well irrigation is carried on extensively. The rainfall is here more copious and reliable than to the south, but the winter rains upon which the important wheat crop depends are reaching their southern limit, and are not always to be depended upon. It has frequently been suggested to harness the Sarda River for the irrigation of this part of Oudh, but the landholders have persistently objected. Recently however they have suffered a change of attitude, and it is hoped to carry water to over 2¼ million acres. The numerous small canals actually within the submontane country form an exception to the protective nature of irrigation throughout the United Provinces. Their chief value lies in the benefit they afford to the rice crop; without them the best qualities produced for the market cannot be secured.

The development of irrigation in the Punjab has differed from that of the older province to the south-east. Here the quantity of water drawn off to protect the thickly settled districts of the east under the Bari Doab and Sirhind Canal systems only deprived the river network of the province of a very small part of its total water volume It has therefore been possible to extend irrigation into the lower doabs embracing the great plains of western Punjab, and to transform extensive arid tracts into flourishing agricultural colonies. Such country as that now served by the Lower Chenab Canal which feeds 2½ million acres and the Lower Jhelum Canal nourishing over 800,000 acres, both of them in the Rechna Doab, and by the Lower Bari Doab Canal † which irrigates nearly 900,000 acres in the Montgomery Plain, is described as having been in pre-canal days a pathless waterless *terra incognita* of which every one stood in dread. The only inhabitants were pastoral nomads who sought whenever possible to swell their legitimate incomes by cattle stealing. To-day these same areas are the seats of model villages, large towns, and busy markets. The enormous output of wheat—rivalling in quality the famous hard red variety of Canada—has occasioned rapid railway growth, and excellent roads have been provided for in the elaborate system of land demarcation which has for its main object the maximum efficiency of water distribution. The original colonists were mostly picked men drawn from the congested areas of south-eastern and eastern Punjab, preference being given to those who were related by common descent and possessed not only experience in irrigation farming but also small means. Very soon, however, the nomads themselves came forward,

* 'Report of the Indian Irrigation Commission,' 1903, part ii. p. 183.

† The Lower Bari Doab Canal is the main feature of what is known as the "Triple Project," a work which undoubtedly represents the most ingenious scheme in India

and receiving every encouragement have proved among the best of the colonists. It is not unusual to read of an erstwhile nomad carrying off a first prize at one or other of the agricultural shows held annually at the various large centres throughout the Punjab. It may be mentioned in this connection that the Thal Project now under construction and designed to irrigate more than $1\frac{3}{4}$ million acres in the Sind Sagar Doab, between the Indus and Jhelum rivers, will afford a wide field for colonization after local requirements have been provided for.

There remains for brief notice the actual method of irrigating the land. Throughout India, with the exception of certain garden lands, water is almost everywhere applied by surface flooding. The land is divided up into compartments (kiari) on either side of the local water-channel, each compartment being defined by ridges of earth along its sides. The water is admitted to the compartment by temporarily breaking the ridges and placing the removed earth across the channel to form a dam. Usually two compartments—one on either side of the water-channel—are irrigated simultaneously. When the water has to be lifted to the surface in order to serve the local channel, as it has from wells and often also from inundation canals, little harm results from this method, for a man employing his own strength or that of his cattle does so sparingly. Unfortunately such is not the case under a perennial system. Here the water reaches the fields under gravity unaided by the cultivator. To him there appears to be an abundance of it, and since he is not charged according to the volume he uses but the area he irrigates, and is anxious to secure as much silt for his land as possible, no other fertilizer being available, there is every temptation to over-irrigate. To this temptation the great majority succumb, and it has been abundantly demonstrated that the cereal growers of northern India are using too much water to obtain the maximum yields.* But this is not the most serious of the evils consequent upon the general practice. The lesson that water is not everything is not an easy one either to teach or to learn in a country whose history has been one of constant distress occasioned by a lack of it. With plenty of water on his land the cultivator feels that little else matters. Drainage receives scant attention, and the surface is seldom worked over. Hence the spread of malaria, rust disease, and alkaline tracts are all assisted, soil aëration is destroyed, and the plants are forced to develop surface roots, thus requiring ever-increasing quantities of water to bring them to maturity. In addition to adequate provision for getting water off the land, success in irrigation depends upon preventing the tendency of soil particles to run together after the application of water, thereby forming a crust which excludes both air and moisture from penetrating

* 'The Saving of Irrigation Water in Wheat Growing,' Bulletin No. 4 (2nd ed.), Fruit Experiment Station, Quetta, 1919, by A. and G. L. C. Howard. Also 'The Irrigation of Alluvial Soils,' Bulletin No. 7, Fruit Experiment Station, Quetta, 1917, by the same authors.

deep down. Irrigation is not to be regarded as an alternative to dry farming. Wherever the need to make a little moisture go as far as possible exists, intensive surface cultivation should be practised. Finally, India presents a parallel to rural England as it was in the days before the enclosure movement. There is minute fragmentation of holdings, so that one man may possess a dozen tiny strips scattered throughout a village. This state of affairs results very largely from the Hindu law of inheritance, but the introduction of English conceptions of land ownership has assisted in no small measure. Such fragmentation involves a multiplicity of tortuous winding watercourses and inevitable wastage. If only holdings could be consolidated without arousing suspicion and causing distress it would permit of extensive remodelling of channels, and would, apart from increasing the efficiency of irrigation a hundredfold, remove the millstone which hangs about the neck of rural India.

Before the paper the PRESIDENT (the EARL OF RONALDSHAY) said: Our lecturer this afternoon is a member of the geographical staff of the Leeds University, a University which, as probably most of you know, is about to celebrate its coming of age. In these circumstances all members of the University staff are naturally much engaged, and we are all the more indebted, therefore, to Mr. Williamson for having managed to find time to come and give us this afternoon a paper upon irrigation in the Indo-Gangetic Plain. Mr. Williamson's attention was first directed to this subject, I believe, on his service in India during the war, and having had his attention drawn to what certainly is a question of very great practical importance, he has since been pursuing his studies in connection with it; and the paper which he is to give us this afternoon is the result of those further studies.

Mr. Williamson then read the paper printed above, and a discussion followed.

The PRESIDENT: Mr. Williamson has dealt with a very interesting subject of great importance, and I should be glad if anybody present would care either to make any comments upon what has been said or to ask any questions with a view to elucidating any points which appear to them to be obscure.

Sir CHARLES YATE: I should like to ask a question with reference to Sind and the map which has just been shown to us. We all know there has been a great deal of discussion on the question of the Sukkur barrage. It is to be built, as I understand, 3 miles below the gorge, and almost all the old experienced engineers in Sind who have spent their lives there in studying the Indus are of opinion that there is great danger of the water being so held up that the swirl above the gorge will break the banks of the river and send it round the outside of the gorge instead of through it to the utter ruin of Sind—the drowning of the people and the devastation of the province. The general opinion seems to be that this scheme has been sanctioned on the advice of a younger generation of engineers who have not had the opportunity of studying the question so carefully as the older men who have spent their lives over it. Can the lecturer tell us what is the state of affairs at the present moment, and what is the opinion in India on the subject?

Mr. A. V. WILLIAMSON: The question which Sir Charles Yate has put is, of course, an engineer's question, and I am not an engineer. But what he says is likely may very well occur according to the older school of thought; has,

in fact, already occurred in the past elsewhere. It happened conspicuously on two occasions along the older canals in the 'eighties of the last century. But this scheme to place a barrage across Sind at Sukkur is not a new one, and I should have thought that time would have allowed of very careful examination of engineering details. Objections have been put forward on many grounds ever since the report of the Indian Irrigation Commission in 1903, but I have seen no objections to the actual structural details. One objection was that if such a barrage was constructed it would be more or less a white elephant, as Sind is so very thinly populated; that it would be far better to spend the money on more densely populated areas. I appreciate that that is not a direct answer to the question, but the point I want to make is that many have objected, and for many years, to the conversion of the inundation canals of Sind into a perennial system, but never has the objection to my knowledge been on the ground of structural details which, I believe, have been drawn up for many years.

Sir EDWARD INGLEFIELD: I think it would be interesting to know when that barrage will be completed.

Mr. WILLIAMSON: In about ten years.

Sir CHARLES YATE: At a cost of £20,000,000.

Mr. WILLIAMSON: That, I think, is one of the reasons—certainly very just—that it is a very expensive undertaking, and it is a question whether the money could not be spent to better advantage in some more densely populated parts, liable to famine.

The PRESIDENT: If nobody wishes to ask any further questions or to add anything to what has been said by the lecturer, I venture, on your behalf, to express the gratitude of this meeting to Mr. Williamson for his extremely interesting paper. He certainly has brought home to us the immense scale upon which irrigation works are carried out in India. Most people have a vague idea that a great deal has been done in Egypt by the irrigation engineer, but few people realize that in British India we have irrigation works before which the works in Egypt pale into comparative insignificance. As an example I might take the very case which has been discussed, that of the Sukkur barrage, the foundation stone of which was laid about a year ago by the late Governor of Bombay, Sir George Lloyd. It is estimated that this scheme, when completed, will bring something like 6,000,000 acres of country which are at present mainly desert under cultivation, and it is estimated that that will add something like 2,000,000 tons of grain and cotton to the present agricultural products of the Indian continent. That is a single irrigation project.

If you take the case of the Punjab, of which our lecturer has spoken a good deal this evening, in that province alone there is an area of something like 9,000,000 acres which has been brought under cultivation by Government irrigation schemes which come under the heading of productive schemes; that is to say, irrigation schemes which within ten years of their inception will pay their own working expenses and a certain rate of interest upon the capital sunk in their construction. If you take British India as a whole you will find that some 67,000 miles of canal irrigate something like 28,000,000 acres of country, the value of the crops raised on those 28,000,000 acres being estimated at something like £156,000,000 per annum. Of course these schemes are being constantly added to. Schemes under construction and in contemplation will bring the acreage irrigated by Government works in the not very far distant future up to something like 40,000,000 acres. That gives you an idea of what has been done by Government.

Perhaps one of the most striking features of Mr. Williamson's paper was the statement that "over one-half of the acreage under artificial watering is nourished by small private works"; that is to say, by wells constructed by the peasantry. If, therefore, the peasantry are responsible for irrigating something like half the total irrigated land in India, that, I suppose, would approximately double all the figures which I have mentioned as applying to big irrigation schemes undertaken by the Government itself.

Mr. Williamson did not say very much with regard to the extreme eastern part of the Indo-Gangetic plain, which happens to be the part I know best personally, namely, Bengal. I might perhaps add, therefore, that in that part of the Indo-Gangetic plain the problem of irrigation is rather different from what it is in the parts with which Mr. Williamson mainly dealt. Eastern Bengal, for instance, is a country which is inundated for several months during the year. Immense crops of rice grow in this inundated country, but unhappily immense crowds of mosquitoes are also nourished in these waters, and one of the great objects of irrigation combined with drainage in Eastern Bengal is to try to kill off the larvæ of the mosquito, which carries malarial fever. Curiously enough, it is only the female mosquito that bites; but she is a particularly dangerous animal because she carries the malarial parasite and imparts it to man. The mosquito breeds in small stagnant pools of water rather than in great expanses of water. What happens in Eastern Bengal is this: When the rainy season comes to an end the waters begin to subside, and there remain immense numbers of small patches of stagnant water on the land. In these the mosquito breeds. The irrigation engineer, therefore, in Eastern Bengal has to try to prevent that happening. He can do it only by constructing irrigation works which are designed to keep the water on the land rather longer than it remains there naturally, so that when he is ready to let the water off the land it flows off with a greater rush, and thus is less liable to leave stagnant pools behind. That is a very big subject, and perhaps I ought not to have embarked upon it in connection with this particular lecture, but it shows not only the immensity of the problems which lie before the irrigation engineer in India, but also their variety and complexity.

Let me once more thank Mr. Williamson for having, as I pointed out earlier, come, at considerable inconvenience to himself at the present time, from the University of Leeds in order to give us this paper. We are most grateful to him.

THE DAKHLA-OWENAT ROAD

W. J. Harding King

NOW that the position of Owenat, with its permanent water supply, has been fixed by Hassanein Bey, it should, as Dr. Ball pointed out in his note on Hassanein Bey's map, prove a most useful base for the further exploration of this part of the Libyan Desert. But to reach it from either the Mediterranean coast or the Sudan by following Hassanein Bey's route would be rather a waste of energy, as these roads have already been surveyed. As Dr. Ball has suggested the route to Owenat from Dakhla as an alternative, a note on the subject may be of interest.

Starting from Dakhla oasis in the winters 1909–1911, I made a number

of journeys along this road in an attempt to cross the desert to Tibesti. It had, however, been so long disused that in most places it was entirely weathered away and no trace of it was to be seen. But by marching on the bearing that I took along it in one sheltered place, where it was still visible, and guessing from the lie of the country ahead where it would go, I managed after many failures to piece it together and eventually succeeded in tracing it for about 200 miles from Dakhla.

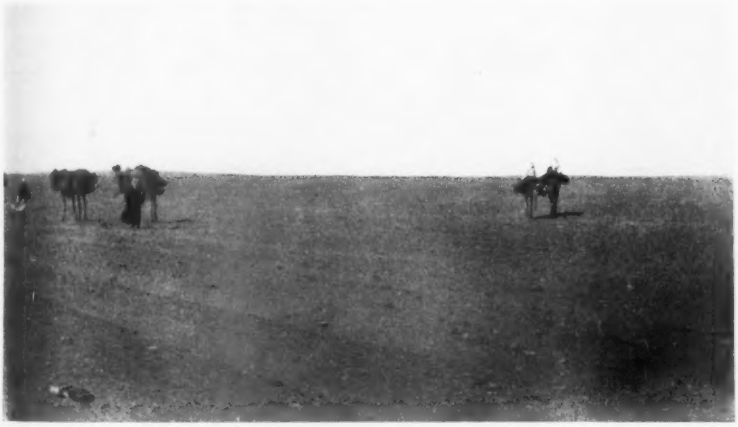
Owing to the habit of camels walking behind each other in single file, the caravan routes of this desert consist of a number of parallel paths. An ordinary caravan road will contain perhaps twenty of these tracks, those in the centre of the road being the most clearly marked; the outer ones, as a rule, being only used when, owing to the size of a caravan, the centre ones are already occupied. In one sheltered place, where this road from Dakhla was still visible, no less than forty-three parallel paths were to be seen, and there must originally have been many others on the edges of the road that the erosion by the sand in the frequent gales had weathered completely away. The road must consequently have been one of the main caravan routes of the desert. Moreover, here and there along it were to be seen "*alems*"—piles of stones set up as landmarks—a marhaka (stones for crushing grain), skeletons, and more or less circular patches of ground a yard or two in diameter, thickly studded with stones, that had been collected from the surrounding desert. These patches used to be made by the old slave-traders to rest their water-skins on in order to keep them off the heated soil and allow the air to circulate beneath them to keep the water cool. In some places a number of these patches were to be seen within a short distance of each other, showing that occasionally the road had been used by very large caravans.

The distance of Owenat from Dakhla in a straight line is about 375 miles, and I think it can be taken as certain that no road that carried such a heavy traffic as this one evidently did in former times can ever have contained a waterless stretch of this length. This is especially true of roads that were used for slave caravans, when the water supply must always have been a very serious problem.

It seems clear that at one time there must have been an intermediate well, or oasis, between Owenat and Dakhla. This may have been only a well, which has since become sanded up and whose very position may now be obliterated. But from what I heard and saw in that part of the desert I am inclined to think that this intermediate place was an oasis, and that it still exists.

I was told of an Arab who had found a cliff about eight days by *hagin* (riding-camel) somewhere to the south of Dakhla—the bearing given me was very vague—and who saw from the top of this scarp a large oasis containing a big ruined town that seemed to be uninhabited and a number of hamlets in which a few people seemed to be living. The oasis contained a number of wells, palms, and olive trees. My

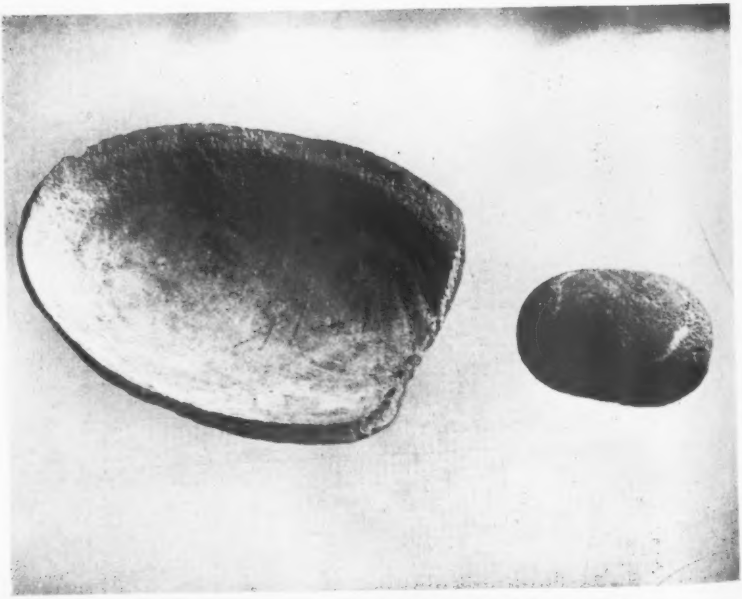
REMAINS OF DAKHLA-OWENAT ROAD



REMAINS OF DAKHLA-OWENAT ROAD

AN OLD GURBA ON DAKHLA-OWENAT ROAD

AN OLD ALEM ON DAKHLA-OWENAT ROAD



A MARHAKA FOUND ON DAKHLA-OWENAT ROAD

informant was not perhaps a very reliable man, and his description may possibly apply to another place I heard of, called the "Egyptian Oasis" (see *Geogr. Jour.*, September 1913); but his information was to some extent corroborated from my own observations.

In the spring a large number of migrant birds come into Dakhla from the south-west. Among them are swarms of palm doves. These always reach Dakhla just before sunset, and generally make first for a particular well in the extreme south-west corner of the oasis.

I went one evening to this well and took the bearing of the direction from which these doves were coming. The mean of these bearings was 217° mag., which corresponded well with the bearing along the road. I then shot some of them and examined the contents of their crops, to see upon what they had been feeding. They had all been eating olives. These when the birds were killed were so far digested that, from some experiments I made, I concluded that they had probably been eaten in the early morning. There is, I believe, no oasis known to exist to the south-west of Dakhla where olive trees grow, yet it seems certain that this olive oasis must exist.

The farthest point along the Dakhla–Owenat road I was able to reach was the hill marked "D" in the map in the *Geographical Journal*, February 1912, which lies about 200 miles from Dakhla. This was a conspicuous hill, standing on high ground and is visible, I was told, from near Owenat.

A very extensive view was obtainable from its summit, the pass marked "C" on the map already referred to being distinctly visible at dawn, although it lay 120 miles away to the north. No oasis was to be seen from the top of the hill; but, if my informant was correct in his statements, the oasis he mentioned lies at the foot of a cliff facing towards the south, and so in any case would have been invisible; but probably the presence of the scarp itself could have been detected if it lay within a day's journey to the south.

From what I saw of that part, I do not think it possible that this olive oasis can be to the north of this hill; nor do I think it can be much beyond it. It cannot be more than two, or at the outside three, days' journey—say 50 to 75 miles—from the hill, otherwise the waterless stretch would have been too long for large caravans to have been able to use the road. It probably lies rather to the east of a straight line joining Dakhla and Owenat, as the road trended rather in that direction; this would make its position about 22° 30′ N., 26° 30′ E.

But the approach to Owenat from Dakhla is not the only one that would lead an explorer through new ground. It should be possible to reach it from the south-west from Tekro or Demi, or else to get at it by way of Terfawi and the "Egyptian" and this "olive" oases, if they exist. A better approach still perhaps would be from Lagia or Bir Natrun, from either of which Merga could probably be easily found.

From here a road is said to run to Kufra, with Owenat halfway along it. If the native reports are to be relied upon, there are several new places waiting to be found in this part of the desert.

W. J. HARDING KING.

THE TERCENTENARY OF COMMON LOGARITHMS

WE are reminded of a tercentenary, which all good surveyors should have celebrated, by the appearance of Part IX. (the first to be published) of the *Logarithmetica Britannica*—a great enterprise planned by Professor Karl Pearson and carried out by Mr. A. J. Thompson, to celebrate the three-hundredth anniversary of Henry Briggs' *Arithmetica Logarithmica*. The Tercentenary of Napier of Merchistoun's Canon of Logarithms was marked at Edinburgh in 1914 with some pomp: the commemoration of his friend Henry Briggs is quieter, but more practically useful, as was Briggs' achievement in comparison with that of Napier. So early as 1615 Briggs had explained to his pupils in Gresham College how it would be more useful if Napier's logarithms were calculated to the base of the ordinary system of numbers, that is, to base 10 instead of to base *e*. In 1616 he visited Napier and accepted from him a further suggestion of detail; in 1617 he published a specimen of the new tables, and in 1624 the table of common logarithms to 14 places for all numbers from 1 to 20,000 and from 90,000 to 101,000: the remaining logarithms being soon afterwards supplied by Vlacq.

The part now published from the Biometric Laboratory of University College, London, contains the logarithms of numbers from 90,000 to 100,000, to 20 places of decimals, with the second and fourth central differences. They have been calculated by the enthusiasm of Mr. A. J. Thompson, of the General Register Office, Somerset House, by methods not yet explained. To economize in cost of printing he prepared the copy for press in the form of paper ribbon perforated on a Monotype keyboard, so that the labour of composition at the Cambridge University Press was reduced to passing the ribbon through the casting machine. This method introduces us to delightful possibilities: one point of some interest is that the natural number, the logarithm, and the differences are set in diminishing sizes of face, but on the same body, which can when desired—though its desirability in this case is not evident—be achieved with ease on the Monotype. The digits are grouped by fives, without any of the unnecessary rules that so often steal away the daylight from printed tables: type and paper are admirable, and the whole table does great credit to all concerned in its production.

In a prefatory note Professor Karl Pearson remarks that "in a

certain sense the day of logarithmic tables to 4, 5, 6, or 7 figures is past. The users of such tables are either ignorant of the existence of slide rules and mechanical calculators, or else unfortunately cannot afford them. Where much computing has to be done logarithms to a few figures are rarely if ever used. What are used, and are often badly needed, are logarithmic tables to 10, 15, or 20 figures." While admitting the last sentence, for we found the need in getting certain geodetic tables computed for the recent conference at Madrid, we do not think that surveyors in the field will readily allow the rest. But we do think that every user of logarithms, however humble, should try to buy the parts of the new tables as they appear, in pious memory of Henry Briggs. They will be published 10,000 at a time, at 10*s*. 6*d*. per part, including postage, from the Biometric Laboratory, one or two parts per year.

GEOPHYSICS IN THE UNITED STATES

Transactions of the American Geophysical Union.— Fourth Annual Meeting, 1923 (*Bulletin* of the National Research Council, Vol. 7, Pt. 5, No. 41). Washington, D.C. 1924. Pp. 150.

THE fourth Annual Meeting of the American Geophysical Union, which was held in April 1923, is described at some length in this number of the *Bulletin* of the National Research Council, and an introductory article by Dr. L. A. Bauer, who was then the chairman of the Union, gives an interesting account of its organization and aims.

The beginnings of the Union are traced back to the National Research Council of America, which was formed in 1916. Dr. G. Hale was its chairman, and he then proposed that provision should be made for "those subjects of research which embrace the Earth, or even the Universe, within their legitimate province."

At nearly the same time a somewhat similar project had been set on foot in this country, for on the occasion of Sir Arthur Schuster's Halley lecture at Oxford in July 1918, a small group of those who were especially interested in these subjects agreed to apply to the Council of the British Association for the appointment of a committee to arrange meetings and discussions on these subjects.

In October and November 1918 preliminary meetings were held at London and Paris to consider proposals for the establishment of an International Research Council, and of Unions to deal with groups of related branches of science; and at Brussels in July 1919 this international body with unions for Astronomy, Geophysics, and Mathematics was definitely established to take the place of such organizations as the International Association of Academies, the International Geodetic Association, the International Seismological Association, and others which had lapsed during or in consequence of the war.

The statutes of each union of the International Research Council contemplated the formation of a National Committee in each country as a corresponding unit, and in February 1919 the National Research Council

of America appointed a committee to consider the organization of a body to represent geophysical science in that country, and its recommendations for the formation of the American Geophysical Union were adopted in December 1919.

The membership of this Union at the present time is seventy-five, which is a considerably larger number than that of most other National Committees for Geodesy and Geophysics, but this figure was adopted in order to have adequate representation of the varied interests of geophysics over the whole of the United States, and also to unite in the union the objects of a National Geophysical Society as well as those of a National Committee. The Union includes representatives of the Government Departments of Fisheries, Mines, Standards, Coast and Geodetic Survey, Hydrographical Office, the Geological Survey, and the Weather Bureau, as well as others from five scientific societies.

As a member of the National Research Council of America the Union holds its meetings in the fine group of buildings which has recently been erected at Washington for the National Academy of Science and the National Research Council, with the aid of the Carnegie Corporation, who gave five million dollars for this purpose, about one and a half millions being devoted to the construction of the buildings, and the balance being held as a permanent endowment in the hands of the Academy for the maintenance of the building and for the support of the work of the Research Council. From this source the Union receives about one thousand dollars per annum for its expenses, especially for those in connection with its annual meetings.

In its constitution, therefore, the American Geophysical Union has a rather wider scope than that of most other National Committees, for besides its international activities its annual meeting provides an opportunity for the communication of papers on various geophysical subjects, and the present *Bulletin* shows that forty-eight such communications were contributed, besides reports on the work which was done at the Rome meeting of the International Union of Geodesy and Geophysics in 1922. In this way a useful summary of what each section of the International Union accomplished was made available at an earlier date in most cases than the publication of the reports which were issued officially by the sections themselves.

The remainder of the meeting was occupied with accounts of the present status of various branches of geophysical science, geodesy, seismology, meteorology, terrestrial magnetism, oceanography, and volcanology; and these took the form of (*a*) addresses given by eminent geophysicists, and (*b*) communications dealing with investigations of various kinds which had been carried out recently.

In geodesy Prof. J. F. Hayford directed attention to the increasing use which other branches of geophysics, especially seismology, were making of geodetic work, and expressed the opinion that before long North America, with its accumulation of geodetic material, will be in a better position than Europe to deal with problems related to the determination of the figure and the size of the Earth. For the present he considered that the most valuable advances in the subject lay in the publication of the large collection of deflections of the vertical and the anomalies of gravity which had been formed in recent years, and in a searching analysis of them.

In seismology Dr. W. J. Humphreys voiced the need for a comparatively few well-selected stations equipped with well-designed instruments which shall be comparable in the information that they furnish. He further asked

for a thorough mathematical analysis of seismic waves under the various conditions provided by the structure of the Earth.

Dr. C. F. Marvin's address reflected the modern spirit of meteorological research by laying stress on the need for the physical investigation of many problems. Solar radiation he placed first, and to this subject the Section of Meteorology at the recent meeting of the International Union of Geodesy and Geophysics at Madrid has also decided to devote special attention. The general circulation of the atmosphere, extra-tropical high-pressure areas, and tropical cyclonic storms were also indicated as demanding special attention. In this country much has recently been done on these subjects, and the Memoir on cyclonic storms recently published by the Meteorological Office contains a wealth of valuable information on this particular subject.

Dr. W. F. G. Swann directed attention to the importance of the study of Earth currents, and of the replenishment of the Earth's electric charge.

Dr. G. W. Littlehales, in speaking of oceanography, urged the importance of extending our detailed knowledge of the configuration of the ocean basins as the foundation of all sound oceanographic work. The recent progress in volcanology was briefly summarized, and some interesting results obtained by Prof. Jaggar in Hawaii, in the vicinity of Kilauea, were referred to. Shortly before the meeting of the Union those interested in volcanology and geophysical chemistry had held a special meeting at which the temperatures of hot springs and the sources of their heat and water-supply were discussed, and a number of communications on this subject read.

The papers presented to the meeting are given in the form of brief abstracts. In geodesy several deal with the employment of radio-telegraphic signals for the determination of longitude; others treat of work done to determine displacements of the surface in the earthquake region of California. The Section of Meteorology received papers on the dust content of the atmosphere in New York, and in the Blue Ridge Mountains of Virginia; also in aeroplanes up to a height of 12,000 feet. In the Terrestrial Magnetism Section reports on Earth currents and the aurora, on magnetic standards and the intercomparison of magnetic instruments, and on relations between magnetic disturbances, gravity anomalies, and geological structure were presented and discussed, as well as papers on similar subjects. In Oceanography Dr. W. Bell Dawson, of Canada, contributed two papers on the determination of mean sea-level, and on estuary tides.

The meeting appears to have been very successful, and the report provides in a convenient form a summary of present and prospective work in geophysics in the United States. H. G. L.

REVIEWS

EUROPE

The Stones of Stonehenge.— E. Herbert Stone. London: Robert Scott. 1924. 11 × 9, pp. xv. + 150. *Illustrated.* 21*s. net.*

MR. STONE has written an excellent account of the stones of Stonehenge, embellished with accurate representations of the stones themselves. The book is, as it should be, mainly descriptive; but there are "glimpses of the obvious," and many passages could have been shortened with advantage. The author deals at length with both sarsens and foreign stones; his general

remarks on the nature and working of sarsen may be commended to the many (including some archæologists) to whom these important rocks are unfamiliar. He is at his best when dealing with structural problems, which he explains by means of photographs of models. If Stonehenge was not built thus (and there is no evidence that it was), it well might have been. Within its narrow but deliberateiy imposed limits, the present book is the best modern account of Stonehenge ; but it falls short of the ideal by reason of those limitations. Nevertheless we think Mr. Stone was quite right to confine himself to certain aspects. He has spared no pains in testing possibilities and theories by means of experiment, so that he speaks upon many points with authority. His courage and enterprise in measuring the ringed stone in the river at Bulford deserve high commendation and reveal the true scientific spirit, for this can only be done when standing "up to one's waist in water." It is remarkable that he should have been the first archæologist to see the stone, others having written about it from hearsay only. The present writer can, however, testify to the difficulty of finding it, though its site is clearly marked on the 6-inch map ; for he failed to do so after a long swim last year. The tales about the devil and the team of oxen will be familiar to students of folk-lore ; they prove the great antiquity of the stone in its present position.

It is as a comparative archæologist that Mr. Stone is weakest. Surely it is untrue to say that Stonehenge has absolutely nothing in common with a stone circle except that its peristyle happens to be circular in plan (p. 34)? Admitting that the dressing and architecture of Stonehenge are unique, yet at its lowest it *is* a stone circle ! Again, the present writer cannot agree that the Altar Stone was originally recumbent. This is a matter of opinion, where analogy helps. He would point to the "Cove" at Avebury and the Obelisk (upright in Stukeley's day, now gone altogether). It is not improbable, in the writer's opinion, that at the centre of both the circles at Avebury huge "dolmens" may have stood, for there is evidence of another upright once standing beside the Obelisk. If so, is it not at least more probable that a similar structure occupied the central position at Stonehenge? For both Stonehenge and Avebury, and other stone circles, may have served the double purpose of tomb and temple ; and we know that the ordinary form of megalithic tomb was a "dolmen." O. G. S. C.

Ordnance Survey of Scotland, "Popular" Edition. One-inch map. Sheets Nos. 90, 91, and 93. *Price* 1*s.* 6*d. each.*

Conventional Signs and Writing for the Revised One-inch Map of Great Britain (Popular Edition), 1924. *Price* 6*d.*

Index to the Popular Edition Sheets of Scotland, 1924. *Price* 2*d.*

The one-inch "popular" Ordnance Survey maps of Scotland are just beginning to appear, and are worthy of particular note because they are so happy a blend of traditional symbol and technical progress. The Scottish small-scale maps have always had their own distinctive features. For example, they have, in the past, been on Bonne's projection whilst the English were on Cassini's. The lettering too has been distinctive and more attractive. No doubt the experience of carrying a new style over England shows where change is advisable on beginning Scotland, and then again Scotland must always be a temptation to the cartographer with its special opportunities of mountain, loch, and forest. The popular edition, on reaching Scotland, is but following precedent in its introduction of modification.

Perhaps the most important divergence from tradition is in the alteration of projection. The whole of the one-inch map of Great Britain is now to be

based on the same meridian (Delamere),* and the sheets are carried forward on Cassini's projection so that there is no break at the border. The most important technical innovation is the total reliance upon heliozincography. The half-inch and the new quarter-inch are of course drawn and heliozincographed, but so far the outline of the one-inch has been engraved on copper.

The size of the sheets is to be substantially larger than that of previous editions of Scotland. Most of them will be the 27 by 18 inch to which the popular edition of England has now accustomed us, but certain sheets are to be much larger. One, for example, is to be 34 by 24 inches. Ninety-two sheets will now suffice for Scotland in place of the previous 131. We cover the ground so much faster these days that the enlargement is obviously desirable.

Each sheet includes an overlap strip of one mile on its east and south edges. This strip will therefore be found also on the sheets which lie to the east and south. There has been a persistent demand for "overlap" which has not been met in the past, principally on technical grounds. Reproduction by heliozincography must make it much easier of attainment.

It is not so long ago that the Ordnance Survey broke away from the repellingly official covers in which folded maps of the earlier editions were sold. The new one-inch of Scotland is to have an attractive cover, a little less topical than in the case of the English sheets, with the Lion in his proper shield and a border of crowns and thistles.

The beauties of the original engraved sheets are so often talked of, and the limitations of lithography so frequently deplored, that one is inclined to look anxiously for blemishes. But indeed they are hard to find in these maps. The lettering is bold but not obtrusive, and the outline too is bolder than heretofore, but both are justified because on a coloured map the outline must be bolder than on an engraved one in order to maintain its importance. On both the old large-sheet series and on the popular-edition sheets of England the names and detail are often too small—and the result is flat. Boldness may obviously be overdone. It is so sometimes, we think, in modern French maps, whilst German are inclined to retain the fineness of execution proper to an engraved map, and the flat effect of a black plate overshadowed by the other colours.

The increased size of lettering applies mainly to towns and villages. The names of "Large Towns" and "County Towns" are very much more prominent, but in general writing is better spaced out, and individual letters more rounded than on the engraved outlines. The sans-serif letters for hills and railway names and sloping lower case for minor headlands are also new, whilst parish names (and boundaries) omitted on the one-inch of England reappear. The larger-sized parish of Scotland is probably responsible for this difference.

A feature which strikes the eye at once is the blocked-in black for towns. So far it has been the custom to use a ruling ("hatching") for the centre portions of towns whilst the suburbs and scattered fringe of houses were shown in solid black. For small towns on a coloured map the solid black (throughout) is certainly preferable and maintains proper contrast with the surrounding parks and woods. It will be interesting to see the effect in Edinburgh and Glasgow.

* It would appear likely that the Delamere meridian was originally chosen so as to allow of both England and Scotland appearing in the same series. Too far west to be central for England and Wales, it is just right for Great Britain.

Parks now reappear on the black plate in the form in which they were shown on the large-sheet series. It is an illogical sign, of course, for to one unacquainted with Ordnance Survey precedent it looks like a black variety of the ordinary sign for sand. But we must be illogical occasionally. For instance, the tree still appears in profile like the mountains, churches, and dolphins on a mediæval map, and yet one would hardly care to change these beautifully clear deciduous and coniferous tree signs for the circles and "crowsfeet" generally used in French cartography. Such signs as these for trees come under the general heading of "ornament" in the Ordnance Survey, and one cannot but agree that there is some justification for the word. "Rough Pasture" is naturally something of a feature on the Scottish sheets. It is pleasant to see the edges, or limits, given. In England the edges of rough pasture are left undefined.

Turning to the blue plate, we find the firm single and double lines reappearing for rivers and streams. All cartographers will welcome them back. The solid light blue stream on the one-inch of England has a wholly indecisive effect.

The contour plate too is a happy one. The "reinforced" 250-feet interval contours help the sense of relief, and the intermediate contours are firm and yet fine. The real difficulty in contouring comes of course when we have to do with gentle yet intricate folds like those of the home counties. "Reinforced" contours help but little there. Either a small vertical interval or some additional shading or hachuring is wanted. In Scotland, however, the 50-feet contours, drawn as they are, should be an admirable guide.

The road classification and colouring remains as before. Some of us will regret it. Few airmen would use a half-inch map, and equally few motorists a one-inch. It seems a pity, then, that these bright red roads should remain to sink the rest of the map into comparative insignificance. It seems to us that one map, and that the one-inch, should aim first and foremost at portraying the country generally and its physical features in particular. Neither the soldier nor the civilian will study the one-inch for his motor routes, but both will desire to follow on it the accidents of the ground.

Many of the alterations which have been mentioned have been made possible by the new fair drawing for heliozincography. Without redrawing it would, for example, have been very difficult and costly to rewrite so many names. Some of these names have, by the way, been stamped, and it would be interesting to know how many users of the map can distinguish between the stamped and the written names.

We think that the Ordnance Survey is much to be congratulated on this new model, and prophesy that it will be still more "popular" than the last edition of England and Wales. H. S. L. W.

The Blue Guides : England.— Ed. by **Findlay Muirhead**. Second edit. London: Macmillan & Co., Ltd. 1924. 6 × 3, pp. lxxxvi. + 632. 81 *Maps and Plans*. 16*s. net.*

Comprehensiveness and compactness must always be the conflicting aims of the compiler of guide books. To supply all the information which the tourist in England is likely to require would be beyond the capacity of even the substantial make-up of a volume in this series. Fortunately the tourist, from lack of time or initiative, rarely strays far from the well-worn tracks. The editor, perhaps realizing this, has grouped his material around a number of routes, which, radiating mainly from London, cover the country fairly thoroughly. The demands which a more enterprising traveller might make, he neatly parries

in advance by touching lightly upon the joys of discovering sheltered corners which, if not "off the map," are at least without the covers of a guide book. Yet Mr. Muirhead interprets his task in no narrow sense: his material ranges from a comprehensive survey of English monuments and a modest glossary for American and Dominion visitors to the price of a night's entertainment at any one of innumerable hotels from Berwick to Land's End. It may perhaps be doubted whether it was necessary to include these last particulars in every case, or to give the railway fares along every minor branch line. However, the appearance of a second edition within four years shows that in the main the guide has successfully stood the test of "usefulness on the spot."

Travels of Carl Philipp Moritz in England in 1782.— A reprint of the English translation of 1795, with an Introduction by P. T. Matheson. London: H. Milford. 1924. $6\frac{3}{4} \times 4\frac{1}{2}$, pp. xx. + 239. *3s. 6d. net.*

This account of a German traveller's experiences in eighteenth-century England was well worth adding to the "Oxford Miscellany," for though the book itself is not unknown, it has only been reprinted twice, and the true standing of the author as a man of letters of no little distinction has only recently been realized. The introduction and notes supply the necessary information concisely and clearly. It might be worth noting that the "road-book," which with a map and 'Paradise Lost' formed his equipment, was that published by Daniel Paterson, the fourth edition of which appeared in 1778. His narrative has a curiously modern, even topical, flavour; almost his first observation on landing in England was on the wretchedness of the weather; later he marvels at the number of advertisements displayed, and complains of the dangers of crossing a street. In setting out for a walking tour, though he spoke English well, Moritz, as he was to learn, had embarked on a bold undertaking. He describes how he was universally regarded as "a sort of wild man, or an out-of-the-way being, who is stared at, pitied, suspected and shunned by everybody that meets him." At times he behaved even more suspiciously, as, for instance, when he sat down by the roadside to read Milton. He had a great admiration for England and her institutions, which he frequently compares favourably with those of his own country, though he never hesitates to criticize. Apart from the wonders of London, he was most struck by the prosperity of the countryside and the privilege of moving through it "free and unmolested." His patience, however, was severely tried at times, generally by the continued rudeness he received at the hands of innkeepers, and, on one occasion at least, when, after scrambling up a hill which promised a pleasing prospect, he was pulled up by a notice, "Take care, there are steel traps and spring guns here." Such incidents, however, were infrequent, and his trip through Windsor, Oxford, and Derbyshire was marred by no serious misadventure. It is evident that Moritz was a keen and witty observer, and an entertaining companion to meet on the road, as proof of which may be cited the cobbler of Castleton, whom he had the utmost difficulty in persuading not to leave his wife and family and take the road with him there and then.

The East Riding of Yorkshire.— **B. Hobson.** Pp. 174 + xii. **Isle of Wight.**— **T. Varley.** Pp. 136 + xii. Cambridge University Press. 1924. *Illustrations and Maps.* *4s. 6d. each.*

The two latest volumes in the Cambridge County Handbooks follow the well-known lines of the series, which now includes over seventy volumes for Great Britain and five larger ones for Ireland. Each volume is complete in itself, and although it contains a good deal of scientific matter is written in a popular and non-technical style. Mr. Hobson's volume, which includes the

City of York, completes the survey of Yorkshire. It has the fullness, accuracy, and attention to detail that are expected of its author. Mr. Varley's volume forms an admirable little handbook to the Isle of Wight. It suffers only from the characteristic of the whole series: that the volumes are too brief to satisfy all interests. The origin and growth of towns might well have fuller treatment. Both volumes are beautifully illustrated and have the usual two coloured maps, geographical and geological.

The Saar Controversy.— W. R. Bisschop, LL.D. London: Sweet & Maxwell, Ltd. 1924. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. v. + 186. *7s. 6d. net.*

With regard to this book, all that it is appropriate to mention in a geographical journal is that it gives some interesting particulars as to the resources of the area with which it deals and the trade in the products due to or associated with the development of these resources. The economic unity of the Saar basin, the author tells us, is derived from its coal, of which, he says, there are three principal groups of mines, one running from Saarlouis to the neighbourhood of Saarbrücken, the second around "Neuenkirchen" (it should be Neunkirchen), and the third in the region of St. Ingbert. But he might have added that these three all lie in the south-east of the area, as extended into Bavaria under the Treaty of Versailles, within a radius of 10 miles from the centre of a circle including all three. The bulk of the book, which is divided into four chapters (entitled respectively History, the Treaty of Versailles, the Interpretation of the Treaty, and the Governing Commission and the League of Nations), together with three annexes, is taken up with a discussion of points of law, equity, and administration. There can be little doubt that the contents will make good the claim made by Lord Phillimore in the Preface, dated 14 December 1923, that the volume "should make a valuable contribution towards the materials for a final decision" on the questions raised. There is an index.

ASIA

Les Races de Haut-Tonkin de Phong-Tho à Lang-Son.— Maurice Abadie, Lieut.-Col. d'Infanterie coloniale. Preface de **M. Paul Pelliot,** de l'Institut. Paris: Société d'Editions Géographiques, Maritimes et Coloniales. 1924. Pp. 194. 122 *Illustrations and a Map.* *Frs.*30.

Colonel Maurice Abadie has spent three years in the districts of Upper Tonking, and therefore is qualified to write of the primitive and little-known peoples who dwell upon its hills. He has approached his task in a scientific and conscientious manner, and the result is a book that is a valuable contribution to ethnography. In a brief geographical and historical survey he shows how great a part the physical conditions of this region have played in determining the customs and mode of life of the various tribes, and then passes on to a detailed description of their daily life, their manners and customs, religious beliefs and ceremonies, their dialects and their picturesque dresses, dividing them for his purpose into four main groups: the Thai, the Man, the Méo, and the Lolo. His sympathy with these hill people is obvious, and he is at pains to show that, although their ways are primitive and although they have remained isolated and untouched by the oncoming tide of civilization, they are by no means the "barbares grossiers" the Chinese make them out to be. Colone Abadie's beautiful photographs, admirably reproduced, give his interesting work an additional value, but it is to be regretted that he did not see fit to include an index. O. R.

Handbook of the Netherlands East Indies.— Buitenzorg: Division of Commerce of the Department of Agriculture, Industry, and Commerce, Java. 1924. 11 × 7½, pp. 334. *Numerous Illustrations and a Map.* 12 *guilders.*

This handsomely produced and well-illustrated volume is a revision of the editions published as the *Year-book of the Dutch East Indies* in 1916 and 1920. It is published only in English, and since it is a compendium of accurate and concise information it undoubtedly achieves its object, which is to give a general review of the present conditions and resources of the colony and its importance for the world traffic. After dealing briefly with the geography and administration, the compilers turn to the natural resources of the islands. The latest available details concerning the sugar, rubber, coffee, tea, and tobacco industries are given, and it is interesting to observe the increasing attention that is being paid to the cultivation of the West African oil palm, especially on the east coast of Sumatra and in Acheen, where the soil and climate appear to be unusually suitable. The chief timber assets are shown to be the valuable teak forests in Java, and figures that indicate the development of the mineral resources—tin, coal, gold, and petroleum—are given. In fact, the handbook will prove a mine of information to business men and those generally interested in the economic conditions of the Dutch Far Eastern possessions, whose total area is half the size of Europe without Russia. O. R.

Arabs in Tent and Town.— **A. Goodrich-Freer (Mrs. H. H. Spoer).** London: Seeley, Service & Co., Ltd. 1924. 9 × 5½, pp. 326. *Illustrations. Price* 21*s. net.*

It would seem almost impossible to write a new book on Palestine, and yet the author of this interesting volume here gives us a great deal about the inner life of the inhabitants of that land which is both new and entertaining. The collection of tales and of social customs here given is the outcome of close observation made off and on over nearly a quarter of a century, and could only have been brought together by one who takes an affectionate interest in the people and knows their language. Six chapters deal chiefly with the ways of women in town, village, and tent. Six more are devoted respectively to Pilgrimages, Hospitality, Bread, Coffee, Property, and Weather, and the remaining ten chapters are packed with anecdotes about animals—from horses to locusts—and trees and plants. The two chapters devoted to the great plague of locusts in 1915 are of special interest. To the ordinary tourist such a book as this will make little appeal, but for those who by residence in Palestine or Egypt have acquired some understanding of the Oriental mind, this collection of "thoughts, customs, and feelings" will prove a mine of good things.

E. W. G. M.

AFRICA

In the Footsteps of Livingstone: being the Diaries and Travel Notes made by Alfred Dolman.— Edited by **John Irving**, with Illustrations by the author. London: John Lane, Ltd. 1924. 9 × 5½, pp. xii. + 269. 12*s.* 6*d. net.*

The title of this book is likely to convey a wrong impression. It was only towards the end of his short life that Dolman's journeys covered ground closely associated with Livingstone, whom he never met, though they had several mutual acquaintances. In 1851 Dolman was on the way to join him when he died a sudden and mysterious death. Just previous to this he had visited Lake Ngami, discovered by Livingstone two years before. But for his early

death (he was only twenty-four at the time) he might well have achieved distinction in African exploration, since he had already given proof of determination, ability, and a taste for adventurous travel. A considerable part of this volume, and that the more interesting, consists of a journal he kept between November 1848 and October 1849, when he travelled from Cape Town across the Great Karroo, through Graf Reinet and Kuruman, to within 20 miles of Kolobeng, where scarcity of water forced him to turn back. This journal is forcibly written, with frequent strokes of humour of a rather cynical strain. Both it and the numerous sketches it contains show him to have been an enthusiastic student of nature, a keen sportsman, and something of an artist as well. His remarks on the Boer farmers and their families are often severe, though when this journal is compared with one describing an earlier hunting trip in the colony, it will be obvious that closer acquaintance brought with it a more tolerant attitude. Despite this original dislike of its inhabitants, and the hardships of travel there, South Africa seems to have exercised an almost irresistible spell upon him. If he was not destined to become one of its great explorers, he has at least left behind him a first-hand and convincing account of its condition and people in the middle of the nineteenth century.

The Autobiography of an African retold in Biographical Form and in the Wild African Setting of the Life of Daniel Mtusu.— Donald Frazer, D.D. London: Seeley, Service & Co., Ltd. 1924. 8 × 5, pp. 210. *Illustrated.* 6*s. net.*

This biography is clearly and simply written, and this, with its directness of appeal, accounts for its success. These qualities are no doubt due to the editing of Dr. Fraser, and in view of his sympathy with, and knowledge of, the natives of Nyasaland, the abandonment of the original intention of publishing it as an autobiography is thus less regrettable than it might have been. In giving the necessary details of the life of a Central African tribe and of the coming of the white men, the main purpose of the book is always kept in sight. During his lifetime, Mtusu, the son of an Abangoni chief, saw a great change effected in his land, in which, as a reckless warrior, a village headman, an early convert to Christianity, and a native preacher, he played no mean part. The conflict between the older social customs of the tribe and the new religion, between the state of almost perpetual intertribal war and the succeeding settled, peaceful existence, is brought out effectively, and the reader will be rewarded by an interesting insight into the native mind and its attitude towards the new order. A striking feature is the relatively peaceful manner in which so considerable a revolution has been carried out. One cannot read the narrative of these events and refrain from drawing a comparison between them and others very similar which took place in our own islands many centuries earlier, an exercise which will considerably vitalize one's conceptions of early British history.

Kilimanjaro and its Peoples.— The Hon. Chas. Dundas. London: Witherby & Co. 1924. Pp. 349. *Map and Illustrations.* 18*s. net.*

Mr. Dundas, who is Senior Commissioner in Tanganyika Territory, has written his book with an obvious love of Africa's greatest mountain and of the dwellers on its lower slopes. The section dealing with Kilimanjaro itself is comparatively short. It sums up concisely our knowledge of the mountain and conveys a fitting sense of its grandeur, but leaves unsolved certain perplexing problems, such as the rapid decrease in the ice-cap.

Of the Wa-Chagga the author writes at length, and he has an instructive

story to tell of the evolution of a people of mixed origin, all migrants to Kilimanjaro in the last four hundred to five hundred years. We are fortunate in being able to trace their development fairly fully. It requires an unusually clear brain, however, to follow all the ramifications of the different clans and families of chieftains, and Mr. Dundas would have been well advised had he provided the reader with genealogical tables. The section on folklore and customs bears testimony to the influence exercised on the people by the great mountain whose sides they inhabit. Like some other mountain races, they suffer physically and mentally if removed to the plains.

The illustrations are good, but the index is unsatisfactory.

F. R. C.

The High Grass Trail.— Frank Savile. London: Witherby. 1924. $8\frac{3}{4} \times 5\frac{3}{4}$, pp. 255. *Illustrations.* 15*s. net.*

This book describes a journey made by the author and his wife in Nyasaland and Northern Rhodesia during the season of high grass and dense vegetation which follows the African rains. It is difficult to appreciate the author's reasons for making the journey at a time when malaria is prevalent and hunting gives such poor results (even when the hunter carries his rifle, which the author rarely seems to do).

It was scarcely necessary to allot some 250 pages to a description of this voluntary journey with its minor incidents and the petty annoyances and discomforts which so many African officials and elephant hunters are forced to face every year. The author writes with good humour and in a very breezy style, but such expressions as " nig " for native, and " For a lame man not so bad. What ? " are tiresome. There are fourteen illustrations of scenes and dead animals, but no map.

J. C. B. S.

The African Elephant and its Hunters.— Denis D. Lyell. London: Heath Cranton. 1924. $8\frac{3}{4} \times 5\frac{1}{2}$, pp. 215. *Illustrated.* 10*s.* 6*d. net.*

Those who expect this book to be a mine of information on elephant hunting, written by a hunter of very great experience, will be disappointed. The work cannot even be considered a good compilation from the literature on the subject, for the many and interesting methods of the native hunter are scarcely dealt with, and references to European elephant hunters consist mainly of a brief chronological record of their lives and books. Perhaps the most interesting chapter is on the nature and values of elephant ivory, taken from a pamphlet written on the subject by a firm of ivory merchants. Those African hunters who treasure that valuable book ' Central African Game and its Spoor,' of which Mr. Lyell was part author, will feel their disappointment in his latest work all the more keenly.

Mungo Park.— W. H. Hewitt. (Pioneers of Progress.) London: Sheldon Press. 1923. $7\frac{1}{2} \times 5$, pp. 75. *Portrait and Sketch-map.* 2*s. net.*

This is a brief and very readable sketch of Mungo Park's life, with most attention naturally devoted to his two journeys to the Niger. These are shown in their true significance by an account of contemporary knowledge of the African interior. The writer has been very successful in bringing out the salient points of Park's character—his courage and determination, his alert and inquiring mind, and his humanity. To this last quality, which led him to take a keen interest in the natives of West Africa and their future, his inclusion in this series is no doubt largely due. Park's claim to be considered an " empire builder " rests not on his achievements as a traveller alone : not only did he open up large areas to external commerce, but indicated the lines upon which they might best be developed in the interests of the inhabitants.

AMERICA

In an Unknown Land.— Thomas Gann. London: Duckworth & Co. 1924. 9 × 5½, pp. 264. *Illustrated.* 21*s. net.*

No one knows better than Dr. Gann the paths and people of the neglected region lying north of Belize and south of Merida, and including the semi-nomad Santa Cruz Indians. These Indians, sullen and degenerate descendants of the great Maya race, re-asserted their independence after the War of the Castes in 1848, since when they have remained practically undisturbed and unvisited, although their territory forms part of the Republic of Mexico.

The present volume deals with an expedition of many adventures made in 1923 by Dr. Gann and Dr. Sylvanus Morley, the chief American authority on Maya glyphs. The interest of this detailed, scientific, and frequently amusing account of journeys to islands and mainland sites from Corozal to Uxmal is heightened by Dr. Gann's background of familiarity with the mixed races of the Caribbean coasts, gained during a lifetime of experience as a Government medical officer in British Honduras.

The party went northwards from Belize in a small sloop, skirting the Yucatec littoral, and visiting and examining several of the " cays " (coral islands) and coastal sites. All Yucatan is a paradise for the archæologist; here are the magnificent ruins of temples marking the last stage of the great Maya migration from the south, the dates found at Tuluum and Chichen Itza proving that great cities flourished during the heyday of the Old Kingdom. As far as the Old Kingdom is concerned, it seems that Dr. Gann accepts the American system of correlation with modern chronology; but the system accepted in this country, supported by evidence quite as good, places these ruins about two and a half centuries earlier. Joyce puts the date of Uaxactun, the earliest dated site yet identified, at about 200 B.C., while Dr. Gann accepts Morley's reckoning of 60 A.D.

The party visited Cozumel Island, first seen by Juan de Grijalva in 1518, cleared the bush all about the hitherto unreported ruins of " Chacmool," between Ascension and Espirito Santo Bays, and proceeded a few miles further north to the fine site of Tuluum, where splendid ruins on the sea's edge mark a city still inhabited at the time of the Spanish Conquest. The expedition had the good fortune to find the fragments of the dated Tuluum stela, seen by John Lloyd Stephens in 1841, by Howe and Parmalee in 1911, and buried by the latter in the sand-dunes. This re-assembled stela, a relic of great interest, may now be seen in the British Museum. A full account of the excavation of the Tuluum site, carried out under the auspices of the Carnegie Institution of Washington, has recently been published in an admirable memoir by Mr. S. K. Lothrop.

Dr. Gann's accounts of visits to other ruins in north Yucatan, and descriptions of the henequen region under a socialist *régime*, are interesting and easily written. The number of misprints is unfortunate, and the very slight sketch-map is not commensurate with the importance of the book.

L. E. E.

Central America: New Paths in Ancient Lands.— L. E. Elliott. London: Methuen. 1924. 6 × 5½, pp. xii. + 280. *Twenty-four Half-tone Plates and a Map.* 15*s. net.*

Miss Elliott is much to be congratulated on the performance of a very difficult task. In less than three hundred pages she has given a most engaging account of the Republics of Central America—Guatemala, Honduras,

El Salvador, Nicaragua, Costa Rica, and Panama—and of our own colony, British Honduras. This account is based not merely on an intimate acquaintance with these regions and their peoples, but on a deep knowledge of their history ; it is set forth in admirable style, enlivened by a keen sense of humour, and is therefore both a delight to read and an invaluable book of reference. Especially will it be of use to those who wish to travel in these lands of romance.

The description of the physical beauties of the region is excellently written. The extremely interesting archæology of this, the seat of the great Maya culture, is touched on lightly but with perfect adequacy. The romantic story of Spanish exploration and conquest, the buccaneers, the break with Spain, the rise and fall of President-dictators—all are treated with an insight based both upon a sound knowledge of early literature, and also upon a sympathetic understanding of local psychology and conditions. The whole is welded together by a host of personal reminiscences of men and things and places, and the result is a book which is eminently sound but also eminently alive. No adequate book dealing with this extremely interesting region as a whole has been published in modern times, and the present volume will be all the more warmly welcomed because it not only fills a gap, but is in itself an excellent piece of literature. The illustrations are well chosen and admirably reproduced ; the index also is good. T. A. J.

Cotton in North Brazil.— Arno S. Pearse. Manchester: International Federation of Master Cotton Spinners. 1923. Pp. 130. *Maps and Illustrations.*

This is a continuation—sometimes an amplification—of the admirable report on 'Brazilian Cotton," published by Mr. Pearse in 1921, and it appears as a supplement to the second edition of that book. It is based on a second journey of the writer in Brazil, in which he paid special attention to the North, *i.e.* Maranhão, Piauhy, and Ceará ; and North-East, *i.e.* Rio Grande, Parahyba, Pernambuco, and Alagõas, particularly the former. (No doubt, the "North-*West*" on p. 12 of the Introduction, is a misprint.)

The book is of great value and very opportune. It deals fully with all the aspects and problems of cotton-growing in northern Brazil, and gives a chapter on World Production and Consumption and some sections on Peruvian cotton. The chapter on Ceará is of special importance, and is followed by one on public works—completed or begun—to counteract the evil effects of drought. These include excessive variation in the amount of the crop (over 70 p.c. in Ceará), which makes it impossible to rely on the output, and such catastrophes to the natives (*e.g.* 1,000,000 cattle dying from thirst in one year in Ceará), that population is driven away rather than attracted. Indeed, the mere survival of cotton at all in Ceará must be associated with the fact that the North and North-East form a zone of *tree*-cotton. Yet these North States show a production of 150 to 300 lb. of spinning cotton per acre—compared with, *e.g.*, 90 in India and 142 in U.S.A. ; and this is reached by the most casual methods of culture.

Obviously, then, irrigation is not only essential but bound to be enormously profitable, both in the actual output of cotton and in the retention of the population on the spot ; and as sugar takes much more water than cotton, the latter is likely to spread widely at the expense of sugar. The race-home of the best native cotton is in the Jaquaribe valley, and here—at Orós—a dam is being constructed larger than that at Aswan. This will convert the river

from a wadi into a perennial stream, and *guarantee* a cotton crop double the present crop in the most favourable year.

Mr. Pearse gives the fullest detail as to the various types of cotton, the qualities of the lint, the various pests, labour and transport problems; and he comes to the conclusion that in no other part of the world is there such an encouraging outlook for the production of really fine cotton on a really large scale. The present reviewer has given attention to Brazilian cotton, especially in the Seridó region, for many years; he believes that Mr. Pearse in no way exaggerates the prospects; and he would venture to recommend the book with emphasis to any one interested in the distribution of cotton and the cotton markets of the world. L. W. L.

AUSTRALASIA AND PACIFIC ISLANDS

Where Cannibals Roam.— Merlin Moore Taylor. London: Geoffrey Bles. 1924. Pp. 320. *Illustrations.* 16*s. net.*

Mr. Merlin Moore Taylor is an enterprising and courageous journalist who went to Papua in search of copy and adventure. He found both on a journey undertaken in company with Mr. W. R. Humphries, Assistant Resident Magistrate, into the mountains of the Gulf Division. He would have done well to mention, however, that Mr. Humphries has already published a record of this particular journey in his valuable book 'Patrolling in Papua.' Mr. Taylor's account is more highly seasoned than that of Mr. Humphries, full of thrills and hairbreadth escapes, but has little value as a contribution to the growing literature on Papua. He differs not infrequently on material points from Mr. Humphries, and his method leads the serious reader to suspect that he is content at times to sacrifice accuracy to dramatic effect. He devotes a book to a narrative of a journey which Mr. Humphries, who obviously looked upon it as part of his day's work, describes in a few chapters, and, reading the two accounts, one cannot but feel that Mr. Humphries' restrained and straightforward narrative is far more effective (and so more convincing) than the sensationalism and so-called "punch" on which Mr. Taylor relies.

O. R.

POLAR REGIONS

My Life with the Eskimo.— V. Stefansson. London: G. G. Harrap & Co., Ltd. 1924. New Edition. Pp. xii + 308. 7*s.* 6*d. net.*

This is a revised and abridged edition of the book which Mr. Stefansson first published in 1913. New prefaces by Messrs. H. F. Osborn and R. W. Brock are added and give some account of the origin of the expedition. There is no indication as to what parts have been excised from the original work or of the nature of the revision, but clearly the essential parts of the experiences and discoveries of that four years' expedition are included. There is no lack of coherence in the narratives. The chapters which give the book particular interest are those dealing with Mr. Stefansson's discovery of the so-called blonde Eskimo of Victoria Island. He prefers to call them the copper Eskimo from the prevalence among them of articles made of native copper. These are the people who gave rise on their discovery to tales of the long-lost Norse settlers in Greenland. While Mr. Stefansson does not definitely support that theory he admits its possibility; but of course purely biological reasons such as the segregation of accidental blonde types may as likely furnish the explanation. In any case the blonde characteristics are not particularly marked in most members of the tribe. The book is supplied with illustrations and maps, and in its new cheap form is a welcome addition to polar literature.

R. N. R. B.

With Stefansson in the Arctic.— H. Noice. London: G. G. Harrap & Co., Ltd. 1924. Pp. 270. *Map and Illustrations.* 7*s.* 6*d. net.*

As a youth of twenty serving on a trading sloop Mr. Noice met Mr. Stefansson at Cape Kellett on Banks Island; he joined his expedition in 1915 and stayed with him two years. Later he had other Arctic adventures, including four years in the country round Coronation Gulf and a season on Wrangel Island, but those experiences do not come within this volume. Mr. Noice accompanied his leader on several of his long journeys, including that in 1916 when he discovered Meighen and Loughead Islands, and that in 1917 when he struck northwards over the pack from Borden Island in search of Crocker Land. Symptoms of scurvy caused the abandonment of the latter journey in lat. 80° 26′ N., "when everything seemed to indicate that land was not far distant." The party retreated to Isachsen Land, where on a diet of fresh meat the two invalids soon recovered. Mr. Noice writes with enthusiasm of Mr. Stefansson's qualities as an Arctic hunter and traveller. It is of interest to note the gradual conversion of the author, at first critical and even prone to condemn, and then gradually admiring and hoping to equal his leader. For Mr. Noice it was the spirit of adventure that prompted him to join the expedition, and he had a rude blow when Mr. Stefansson ridiculed adventure as a sign of blundering incompetence, and told him that so far from there being anything heroic in Arctic exploration it was all a matter of learning and following certain simple rules which rendered it as safe as life in civilization. No doubt Mr. Stefansson was overstating his point of view to test the youth. In any case, if adventure is new experience under novel conditions of life there is plenty of adventure in this volume—more adventure than discovery, for the tale has already been told in Mr. Stefansson's own book. But it is a pleasant brightly written book, and incidentally is a tribute to Mr. Stefansson's sterling qualities. There is a useful map, but no index. R. N. R. B.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Grundzüge einer vergleichenden Seenkunde.— W. Halbfass. Berlin: Gebrüder Borntraeger. 1923. 10 × 6½, pp. vii. + 354. 110 *figures in text.*

Limnology, or the science of lakes, is of modern origin. Its foundations were laid by F. A. Forel, whose great work 'Le Léman' is by far the most perfect limnological monograph in existence. In our own islands the Bathymetrical Survey of the Scottish Freshwater Lochs instituted by Sir John Murray has produced results which rival those of Forel in accuracy and interest, but hardly in completeness. Investigations of great value have also been carried out in many other regions, but from the scientific point of view Lake Geneva is still the best-known lake in the world.

So many sciences are directly concerned in the study of lakes that papers dealing with some branch or other of limnology are to be found in the most diverse publications, and to collect them with any approach to completeness is a work of great labour and difficulty. Hitherto there has been no comprehensive guide to this widely scattered literature. Forel himself wrote a 'Handbuch der Seenkunde' which was published in 1901, but, as its subtitle indicates, it is a "general" and not a "comparative" limnology. It deals with laws and principles rather than with actual observations, and it is based chiefly on its author's own researches. Apart from the fact that the science has not stood still since 1901, there was room for a work which should collect observations on lakes from all parts of the globe and compare the results.

This is the purpose of Prof. Halbfass's book, and no one could be better qualified for the task than its author. He has devoted the greater part of his life to the study of lakes and has carried out many valuable investigations, especially upon the physical side of the subject. In his "Die Seen der Erde" (*Petermanns Mitteilungen*, Ergänzungsheft Nr. 185, 1922) he has collected the data available with regard to the area, depth, etc., of some fifteen or sixteen hundred lakes, his aim being to include all lakes of which the depth is known and which have an area of at least a square kilometre. In his "Methoden der Seenforschung" (in Abderhalden's *Biologische Arbeitsmethoden*, Berlin and Vienna, 1921) he has dealt with the instruments and methods employed in the examination of lakes.

So far as it is possible in a volume of moderate size, Prof. Halbfass's book fulfils its purpose and will prove invaluable to the student of the subject. Only the geologist and the biologist will be disappointed in referring to it. The former is interested chiefly in the origin of the hollow that holds the lake rather than in the water that fills the hollow. The latter is concerned with the plants and animals that live in the water. Prof. Halbfass, though he deals exhaustively with the forms of the hollows, says little about their origin and gives few references to the extensive literature that has grown up around the question. With regard to the life within the lake, he modestly confesses that in this matter he feels himself too much a layman to do more than attempt a cursory review, and he deems himself fortunate to be able to refer to recent works which treat the subject more adequately.

In its general arrangement the book follows nearly the same lines as Forel's Handbuch. In both there are sections on morphology, hydrology (including sources of supply, outflow of the water, changes of level, etc.), hydraulics (including, for example, waves, seiches, currents), chemistry, temperature, optics. In addition Prof. Halbfass has a chapter on acoustic phenomena, and another on anthropogeography, in which such matters as fisheries and commerce are somewhat briefly dealt with. There is also a short note on the political ownership of the waters of lakes, and finally a postscript on the Russian investigations in the Caspian Sea in 1914–15 and on some yet unpublished maps of Japanese lakes.

But the method of treatment is very different from that of Forel. The latter, as already remarked, deals mainly with principles and not with the details of individual lakes. Prof. Halbfass, on the other hand, quotes actual examples throughout, and since he gives numerous references, his reader will find him an admirable guide to the work which has already been done in any branch of the subject (except geology and biology) in which the reader himself is interested. It is a matter of little consequence that the geological and biological aspects of lakes have been comparatively neglected, for these have been fully dealt with by other writers; but the expectant reader should remember that the book is a comparative limnology. Methods of observation are, indeed, briefly described, but for fuller information on this subject he should refer to the author's "Methoden der Seenforschung" already mentioned.

So far as the text is concerned the book is well produced. The illustrations include maps, diagrams, and photographs. The maps and diagrams are in most cases quite clear, but in some the lettering is too small for easy reading. The photographic reproductions are at best moderate, and one or two are distinctly bad. This, however, is a very small and unimportant blemish in a book so useful as that of Prof. Halbfass. P. L.

HUMAN AND HISTORICAL GEOGRAPHY

Elephants and Ethnologists.— G. Elliot Smith. Illustrated by **A. H. Gerard** and **K. Leigh Pemberton.** London: Kegan Paul. 1924. 10 × 7½, pp. viii. + 136. *Illustrations.* 15*s. net.*

This work is devoted to the discussion of a piece of evidence of the transmission of Asiatic culture to America in pre-Columbian times. On the remarkably carved Stela B at Copan, in Honduras, a product of Maya art, are the heads of animals showing a distinct trunk-like structure. Is this the trunk of an elephant? Prof. Elliot Smith says yes, and moreover that the elephant is of the Indian species, and he has written this book to prove it. Mr. Maudslay, who has made the most thorough examination of the Stela, regards the structure as the snout of a tapir, an indigenous animal. Leading American authorities scout the views of Elliot Smith, believing it to be the beak of the blue macaw. A striking point in the author's favour is that above the head of the animal with the trunk is the head of a man wearing a characteristic Indian turban. See here, he says, is the Indian turbaned mahout on his elephant. Another curious and significant corroboration is the spiral ornament on the side of the head of the animal with the trunk on the Stela B, which corresponds to a similar design on sculptures of the elephant in India and elsewhere in the Old World.

The second chapter describes other supposed representations of elephants in the Maya manuscripts and elsewhere. Here a quotation will make clear the author's views which the rest of the book is written to expound and support. "It is the Indian elephant," he says, "that is represented in these American sculptures and drawings, with the symbolism of Eastern Asia, illustrating myths which came from the Old World. In other words, it is not the fact of the elephant being depicted that chiefly interests us, so much as the conventional trappings which surround it and establish the time at which it was introduced into America, and the place in the Old World from which it came. The pictures were clearly not made by any one who knew the elephant."

Corroborative evidence is sought from a study of the mythical crocodile known in India as the Makara. A plate shows a Maya pot in the form of a crocodile Makara with a man emerging from the gaping mouth. "Nowhere in the derivation of American culture from Asia more obtrusively displayed than in the representation of men or gods emerging from the gaping mouth of some mythical monster analogous to the Naqa or Makara of the Old World."

In discussing the Date of the Diffusion of Culture to America the problem of the migration of the Polynesians across the Pacific is treated with insight, though perhaps with some exaggeration, as when it is asserted that "many thousands of boatloads of immigrants" must have arrived on the Pacific coast of America, bringing with them a variety of contributions from the civilization of the Old World. The author is confident that Western culture was playing a part on the threshold of the Pacific as early as 1000 B.C., and he says that in figurines from sites in Mexico of date as early as 200 B.C. turbans of characteristically Indian type are represented. But he considers that Stela B was a much later work, dating probably from about 600 A.D.

In conclusion, Prof. Elliot Smith contends that all the evidence afforded by the comparative study of the Maya civilization of America points clearly and definitely to Indo-China as the chief source of its inspiration. In Cambodia the people have a deep affection and admiration for the elephant,

and a sculptured representation of the elephant is the favourite architectural decoration. He suggests that a source from which the Maya sculptor obtained his ideas of the elephant may have been small model elephants carved in sandalwood carried by seamen coming from this part of the Asiatic continent.

This learned and stimulating exposition owes its importance to the fact that if its conclusions are established it undoubtedly proves that the culture of the Old World reached Central America in pre-Columbian times. Its arguments cannot be brushed aside by American archæologists with contemptuous remarks. They deserve and demand serious consideration. There are numerous illustrations in black-and-white line. This is an unfortunate method for the purpose, because the elaborate carvings on the Stela and the drawings in the manuscripts are not at all clearly brought out. Good photographs would have been much more helpful. E. A. P.

GENERAL

Mountain Climbing.— **F. A. Collins.** London: John Long, Ltd. 1924. 7½ × 5, pp. vi. + 314. *Illustrated.* 10*s.* 6*d. net.*

Besides relating the history of the ascents of the more famous peaks, the author of this readable book gives some advice to would-be mountaineers. As he says of snow climbing, "It cannot be learnt through a correspondence school," so that his remarks are of necessity very general, and these chapters are filled out with rather elementary disquisitions upon barometers, how to find the south, the nature and origin of mountains. The historical side is done better; the writer has a lively style and maintains the interest well. There are however several misprints, and at least one error, where it is stated that K_2 is 2000 miles from Mt. Everest. The chapter on the Everest expeditions, also, is rather poor: the mountain was not discovered in recent years by Colonel Everest; nor is it the main purpose of the expeditions to determine its height.

Adventures of Carl Rydell.— Edited by **Elmer Green.** London: E. Arnold & Co. 1924. Pp. xii. + 308. *Illustrations and a Map.* 18*s. net.*

The writer of this autobiography began his seafaring life some fifty years ago in the Swedish Navy, then passed to the merchant service, and eventually drifted to San Francisco. Then began many years of adventure: hunting, sealing, salmon fishing, gold mining, and every kind of maritime enterprise. The stream of experience carries the reader to Alaska, Japan, the Bering Straits, the islands of the Pacific, and eventually to the Philippines; there is no lack of variety. The author never boasts or glorifies his actions, and there is a happy absence of moralizing. The style runs on, evenly and unemotionally through days of storm, shipwreck, hunger, and every kind of adversity, and here and there a streak of good fortune. One has to read between the lines to appreciate the excitement and danger of a score of situations which the author recounts merely as part of the day's work. Time and again the reader hopes Mr. Rydell will stop the steady stream of reminiscence and be content to dwell a little longer on some event, but his restless pen is off again. There is raw material for many tales of high adventure in this book. Its geographical value lies chiefly in its account of the seal fisheries of the North Pacific and the early days of gold mining in the Seward Peninsula of Alaska. A useful map makes it easy to follow the author's travels. R. N. R. B.

Around the Horn to the Sandwich Islands and California, 1845–1850.— **C. S. Lyman.** Edited by **F. J. Teggart.** New Haven: Yale University

Press; London: Oxford University Press. 1924. Pp. xviii. + 328. *Illustrations.* 16*s. net.*

Mr. Lyman, who was for many years a professor in Yale University, died in 1890 at the age of seventy-six. As a young man he sailed as a passenger round the Horn in 1845, and subsequently spent some years in the Sandwich Islands and California. The present volume is his diary of those years edited by Prof. Teggart. A few contemporary illustrations and two sketch-maps are added. The voyage round the Horn occupies only a few pages and contains nothing of striking interest. That experience has been treated often by abler writers. The most interesting parts of the book are the descriptions of Valparaiso and Lima, the chapters on native life in the Sandwich Islands, and the account of the early days of the gold rush in California. These pages are vivid and have historical value, but much of the diary is merely a bare record of movements and weather and makes monotonous reading. The editor has been too conscientious in retention where excision would have improved, and it was surely unnecessary to disfigure the pages by inserting in brackets the letters or words which the diarist omitted. In other cases the author's contractions are allowed to stand. A slavish adherence to the text is uncalled for in a manuscript which is of value for its matter and not for its literary history and associations. It should be added that the book is admirably produced and has a brief life of Prof. Lyman as a preface.

R. N. R. B.

The Teaching of Geography.— W. P. Welpton. London: University Tutorial Press. 1923. Pp. 160. 3*s.* 6*d.*

The task of the school teacher is not to make geographers but to excite the pupils' imagination and interest, and to quicken their intellectual and moral sensibilities towards the problems of life and the world. Of course the same duty devolves on the teacher of all other school subjects. The teacher of geography is not concerned to accept geography as defined and outlined by the geographer. As a teacher of pupils rather than a teacher of a subject he is entitled to adapt the subject to his aim. Mr. Welpton believes that for school-children the important part of the subject is the human side, and for school purposes he would define geography as the study of the peoples of the world. He would not overlook teaching in physical geography, but maintains that the details of physical features are facts of little importance except to those specially interested. They cannot, so he thinks, hold the child's attention and stimulate its imagination as human problems can. No doubt the bones of geography can be made dry, but the fault in this case lies with the teacher and not the subject. "The purely academic and professional outlook of the geographer" against which Mr. Welpton warns the teacher is not always so narrow and dehumanized as he appears to think. All geographers of to-day were not fed solely on academic lore: most have had a wide experience of travel and personal touch with many problems. Yet we must admit that the warning has some justification. Mr. Welpton outlines a junior course that should largely be illustrative of man's life and work developed in a descriptive fashion. This should run parallel with a direct study of the home district. The senior course should provide more connected and continuous study with more appeal to reasoned explanation. Various methods of carrying out these suggestions and the relations between geography and other school subjects are discussed. The book is full of valuable suggestions even if all do not meet with general acceptance. It certainly is an excellent presentment of the value of human

geography in the education of the citizen, an aspect of adult education that is often overlooked. R. N. R. B.

An Economic Geography of the British Empire.— C. B. Thurston. University of London Press. 1924. Fourth Edition. Pp. 385. 5*s*.

The British Isles of To-day.— J. F. Unstead. London: Sidgwick & Jackson. 1922. Pp. 184. 3*s*.

The Thames Basin.— M. Michaelis. Oxford: Clarendon Press. 1923. Pp. 140. 2*s*.

Mr. Thurston's book is a new and revised edition of a volume first published in 1916, and contains new chapters on the mandated territories of Mesopotamia and Palestine. The book is clearly written, accurate in its facts, and takes a wide enough view of the scope of economic geography to allow its use as a text-book in schools, although it may be doubted if concentration on Empire geography to the exclusion of other lands is advisable. A few small matters call for comment. Dundee no longer has a whaling fleet, but Leith has for some years sent out whalers. The population of the Falkland Islands cannot be said to be of "mixed European descent"; it is almost entirely of British origin. The division of the races of mankind into five colour-groups is a little misleading and might well be avoided. There are many useful sketch-maps.

Prof. Unstead's latest addition to his Citizen of the World Geographies gives a readable and well-balanced account of the chief aspects of the geography of the British Isles. He has succeeded in making an interesting book, brief though it is, which is at once descriptive and explanatory. It deserves to be widely used. We note one mistake: Tweed cloth is not named after the river, but derived from twill.

As an elementary geography for children who live in the Thames basin, it would be difficult to find a better book than Miss Michaelis has written. Her book includes a great deal of matter explained in a fresh and interesting way, with appropriate exercises for pupils. The illustrations and maps are excellent. This cheap volume deserves to be widely used in schools in the Thames basin as an introduction to geography by means of a study of the district at hand.

R. N. R. B.

"Let's See" (Aids to Memory).— R. M. de la Sala. Manilla: P. I. 1923. $9\frac{1}{2} \times 6\frac{1}{4}$, pp. 30. $2.50.

The author's intention in this little book is to remind sailors of facts they ought already to know. He emphasizes certain interesting points, but is somewhat behind the times in stating that the majority of navigators are so particular to calculate and observe when the object is on the Prime Vertical. The necessity for doing that is gone.

All navigators should be able to identify the planets and principal stars at sight, even when they emerge from a rift in the clouds. Venus and Jupiter should be picked up easily in daylight when not too near the sun and at a fairly high altitude.

The book should be a useful help in recalling points that may slip one's memory. D. W. B.

THE MONTHLY RECORD

EUROPE

Emigration from the British Isles.

THE trend of pre-war emigration from the British Isles to the Empire, and the effects of recent settlement schemes, are analysed by Miss B. Hosgood in the *Scottish Geographical Magazine*, 16 September 1924. Before 1914, on an average 250,000 emigrants left each year, 82 per cent. of whom went to other parts of the Empire. In most cases they were not of the type required by the Dominions, as they drifted to the towns and aggravated the unemployment problem. Consequently, there was a good opening in agriculture for foreign emigrants, who increased in number, so that in Canada, for example, between 1909 and 1914, only 36 per cent. of the immigrants were British. The reasons for remedying this state of affairs, especially after the war, are obvious.

The work of the Overseas Settlement Committee was limited to assisting ex-service men to emigrate. During the period of its work, April 1916–December 1922, 86,000 were sent abroad; of these 42 per cent. went to Australia, 32 per cent. to Canada, and 15 per cent. to New Zealand. Besides this ex-service movement, the total emigration to the Empire reached a "peak" in 1920, when 230,000 left; this was followed by a slump in 1921 and 1922, followed by a recovery in 1923. In order to encourage all classes of emigrants, but particularly agriculturalists, the Empire Settlement Act was passed in 1922. This provided for the co-operation of the Home and Dominion Governments, the former guaranteeing to pay half the expenses of each settler, up to a total of £3,000,000 per annum. During the first fourteen months only 53 per cent. of the emigration possible on the above basis took place, the reason given being that the machinery was not yet perfected. In 1924, it is estimated, less than 50,000 British emigrants entered Australia under the Act, and in New Zealand the figures were below the average. Of all the Dominions, Australia is most alive to the need for immigrants, consequently her policy of encouraging large-scale settlements has been particularly active. In Western Australia, 8000 have been settled on the Bunbury-Albany scheme, and arrangements have been made to increase the number to 75,000. In connection with the Murrumbidgee irrigation project in New South Wales, the government is arranging for farms for 6000 settlers, and similar schemes have been initiated by Victoria, South Australia, and Queensland. The action of Canada has been more deliberate, though her resources are by no means developed, and the rate of increase of population is falling off. In 1920 51 per cent. of her immigrants were British, the majority being English, but during the same year the Continental immigration had increased by 242 per cent. The tendency is for the British to concentrate in Ontario, and to a lesser extent in Quebec. In New Zealand, arrangements were made for 10,000 emigrants annually for five years, but this figure has not been reached. The returns show the unusual feature of a slight but continued and progressive excess of female immigrants. It will be seen that up to the present the Empire Settlement Act has not had much effect in stimulating Imperial emigration.

La Grésigne, a Region of France.

A detailed study of a French region, La Grésigne, in which the intimate connection of the physical features, the history and the life of the inhabitants

is well brought out, is contributed by P. Deffontaines to the *Annales de Géographie* for September 1924. Grésigne is used to denote an outlying spur of the Central Massif to the south-east of Cahors which projects into the great plains of Aquitaine. Its wooded dome, rising to a height of nearly 500 metres, dominates the undulating landscape. Geologically, it is the result of the continuation of the Villefranche–Najac fault, the dome consisting of Triassic and Permian sandstones thrust up through the Tertiary molasse of Aquitaine. The centre of the dome, being of argillaceous beds, has been more rapidly eroded than the outer quartzite sandstones, so that the centre of the massif is enclosed by an almost unbroken wall. The significance of the region lies in its possession of timber and stone, in which the surrounding country is lacking. The population, known as Grésignols, with distinctive characteristics of their own, is very sparse. Besides an outer ring of towns along the edge of the forest, there are hamlets, which contrast with the less concentrated population of the plains. The canton of Castlenau, an average example, has a density of only 30 per sq. km. The forest, now reduced to an area of 3245 hectares, is chiefly composed of oaks and hornbeams, though fir plantations are increasing. In the thirteenth century it became Crown property, and after a protracted struggle most of the popular forest rights were suppressed. Because of its inaccessibility and the general abundance of timber, it remained unexploited by the Crown. In 1770 it was leased to a private person for exploitation: this was now possible since the Aveyron had been made navigable up to Montricoux and the Vère improved, while the resources of other forest areas were being exhausted. The Gaillac–Bruniquel road, made in 1810, opened up the heart of the massif. Though utilizing the timber, the Grésignols had never been good woodmen, so that in 1770 a colony of foresters was introduced from the Vosges and later from Auvergne. A large amount of charcoal is still used for cooking in the south, and mule-waggons from Grésigne distribute it as far afield as Toulouse. Sawing up the trunks has naturally been the chief occupation, but minor industries, mainly carried on in the homes during the winter, have flourished, such as making barrel staves, hoops, flails, wheels, and bobbins, the latter to supply the textile centres of Cordes, Montricoux, and elsewhere. Furniture was also extensively made, but its export was difficult, and the craftsmen have migrated. Some glass works and iron foundries also operated, the iron being got from deposits of siderolithic sand. Unfortunately the period of prosperity, culminating in the middle of the nineteenth century when these industries were flourishing, has been killed by intensive, to some extent foreign, competition. Much the same has happened to the stone industries. The demand for mill- and grindstones has declined, while the building stone, from lack of transport facilities, cannot easily be exported. Consequently masons and other workers have had to migrate. For limestone the position is better, for it is in demand as road metal, and the vineyards of Aquitaine also use a good deal of lime. Even in agriculture the position is becoming worse. Labourers deprived of the support of the subsidiary industries are seeking work elsewhere: much land is being devoted to fodder, while some is going out of cultivation altogether. In consequence of all these factors the population is decreasing: abandoned houses are frequently to be met with, and the population of Vaour, for instance, has fallen in fifty years from 900 to 420. M. Deffontaines describes its condition as one almost of economic death, surrounded by the evidences of former prosperity.

Seasonal Migrations in Central Sweden.

One of the most direct manifestations of man's dependence on geographical factors is the seasonal migrations of pastoral peoples in the search for sufficient

fodder for their flocks and herds. The subject has of late been carefully studied in various quarters, and the contributions of writers like Sarre, Arbos, and others have been referred to from time to time in the *Journal*. An interesting inquiry into the conditions under which such seasonal migrations (for which the French use the term "Transhumance") take place in the district of Siljan in Dalecarlia has been made by Mr. John Frödin, who has spent two summers in the district, and has published his results in the *Geografiska Annaler* (1924, Häft 1).* The practice varies in different regions, and while the summer pastures in the Alps (and elsewhere) are generally above the forest-line, in Sweden they are entirely within the forest zone. Here, again, the main industry is now dairy farming, rather than the production of meat or wool, though in old days the proportion of small stock was very much greater. In the special district studied, which lies all around Lake Siljan, the zone of permanent habitation forms a ring near the centre, on ground composed of the cultivable clays and sands of the Ice Age, while the outer portions, formed of stony morainic deposits or peat-mosses, are unfertile, and for this reason, rather than for any rigour of the climate, have been mainly devoted to summer pasturage. Mr. Frödin traces clearly the various stages by which a complex system of summer chalets spread outwards from the permanent villages in proportion as the head of cattle increased, those at first used in summer only becoming in turn more or less permanently occupied, while still more distant ones were established. In early days the pasturages were the common property of the villages, but private ownership gradually came into force as the collections of huts grew larger, each dwelling having its small meadow, with barns and cow-sheds. As the ground in time became manured by the cattle, small attempts at agriculture were made at some of the nearer groups of chalets, though dairy farming remained the principal occupation. Eventually some of these temporary settlements passed into the category of permanently occupied ground, and formed fairly dense agglomerations, though side by side with these were widely scattered farms. Before the timber-cutting industry invaded the district, half a century ago, only some 20 per cent. of the whole area fell within the zone of permanent occupation, and without the seasonal migration the remaining 80 per cent. would have remained useless. An event of great importance to the pastoral industry was the re-apportionment of lands during the first half of the nineteenth century, known as the "Storskiftet": for a time at least this had the effect of increasing the head of cattle in the pasturages. In recent years the rise of the timber industry has acted to the detriment of the pastoral, and recourse has been had to areas of marsh and peaty ground to supplement the other pastures during part of the year. The writer describes in detail the systems of migration practised, and its variation between the different communes. For that of Sollerö it is particularly complex owing to the distance of some of the pastures from the main village, necessitating the use of intermediate groups of chalets.

ASIA

Irrigation in the Chengtu Plain.

The productiveness of the Chengtu plain in Szechwan depends upon extensive irrigation works. At Kwanhsien part of the water of the Min river has been diverted into an artificial side channel and distributed over a large area. The credit for this piece of engineering is generally given to Li Ping, Prefect of Shuh, soon after 316 B.C. The Rev. T. Torrance contributes a

* The subject of summer migrations of the kind in Norway is introduced with effect in Miss Martineau's well-known tale 'Feats on the Fiord.'

paper to the *Journal of the North China Branch of the Royal Asiatic Society*, vol. 55, 1924, in which he seeks to show that, while Li Ping extended these irrigation works, they are of a much earlier origin. He gives a reference to a quotation in the "Shuh Chi," drawn from a book of the Hsia dynasty (2205–1818 B.C.), which, he argues, refers to irrigation works in this region. There is another reference to the "Shu Chi" where it states that Pieh Ling several hundred years B.C. cut a passage through the Ü-Lui mountain to save the country from inundation. For various reasons advanced, Mr. Torrance identifies the Ü-Lui Mountain with the ridge through which the waters of the Min river run in an artificial channel. This antedates the initiation of the irrigation scheme by about two hundred years, placing it before the coming of the Chinese to the West. Li Ping undoubtedly did much to improve these works, and Mr. Torrance gives a translation of an extract from the "Shuh Chi" which describes his activities in this connection. His main work was to deepen the channels and to build a dam from the Litui rock into the middle of the river, by which a greater quantity of water was diverted. He also laid down a precept for the regulation of the system—"Keep the channel deep and the river-banks low." In the course of centuries, as the population increased, the plains have been covered by a network of irrigation canals, which supply the necessary 9 feet of water for the rice-fields.

AFRICA

French Motor-Expeditions in Africa.

The Sahara has recently been crossed several times by French expeditions in motors. One party of eight Citröen-Kegresse caterpillar traction motor cars under MM. Hardt and Audouin-Dubreuil, who made the first motor crossing of the Sahara about a year earlier, left Colomb-Bechar on 28 October 1924, and travelling *viâ* Lake Chad, reached Mao, in Kanem, on December 20. After a difficult journey over the broken country to the north and east of the Lake, they reached Fort Lamy in about eight days. By January 1 they had left for Banghi on the Belgian Congo frontier. The leaders are said to intend later to cross the continent through Wadai and the Anglo-Egyptian Sudan, ending their journey at Jibuti in French Somaliland. The importance of the first part of their achievement is that previously communication with Fort Lamy has lain along the roads of British Nigeria, while their caterpillar traction cars allowed them to travel entirely through the French territory to the north. It is also announced that Lieut. G. Estienne and M. R. Estienne have crossed the Sahara from Save, the northern termination of the Dahomey Railway, to Colomb-Bechar in two six-wheel Renault cars. The journey took 149 hours altogether. Another French automobile expedition is also making good progress. M. Edmond Tranin left Konakri in French Guinea with a party in an attempt to cross Africa to Jibuti. On December 19 they were at Bamako on the Niger, and by January 4 they had reached Lake Chad. The cars are equipped so that palm oil may be used as fuel. Another enterprise which may be noted here is Captain Pelletier Doisy's attempt to fly from Paris to Lake Chad, though the start has been delayed. The four main stages of the proposed flight are Colomb-Bechar, Timbuktu, Fort Lamy, and Bangi. The return journey is to be made along the Atlantic coast, *viâ* Zinder, Dakar, and Tangier, but it is thought that, should the conditions be favourable, this would be abandoned in favour of an attempt to fly to Zanzibar and Madagascar. The purpose of the flight is to study the prospects and conditions of commercial aviation. Captain Pelletier Doisy will be remem-

bered as the hero of the recent remarkable flight to Tokyo. This trans-Saharan activity was to have been the prelude to the establishment of a regular tourist service to Timbuktu. M. Citroyen, the organizer, however, has felt obliged to cancel all his plans and preparations, through uncertainty as to the condition of affairs in southern Morocco. It is stated that the Algerian military authorities refused to guarantee the safety of the tourists from possible attack by Moorish rebels.

Hassanein Bey: Geological Conclusions. Erratum.

Through an error in the copy, a phrase was unfortunately omitted from Dr. Hume's article on the geological results of Hassanein Bey's journey to Kufra and Owenat, printed in the November *Journal*, 1924. The fourth paragraph from the bottom of p. 387 should read, "the granitic range rises high above the sandstone which surrounds it. This difference of level," etc., and not "the granite difference of level. . . ."

AMERICA

The Californian Raisin Industry.

A striking example of the influence of geographical factors upon an industry and their limitation to a comparatively restricted area is shown in the case of the California raisin industry. The interrelation is well brought out in a paper contributed by C. C. Colby to the *Annals of the Association of American Geographers*, vol. 14, No. 2, June 1924. Raisin production in America is confined to a strip of country, about 90 miles long and 20 to 40 miles wide, running along the middle section of the San Joaquin valley. Further, in 1921 81 per cent. of the total production came from the Fresno county district, covering about one-third of this area. The vineyards are on the irrigated middle slope of the piedmont alluvial plain between the western foothills of the Sierras and the valley bottom. Grapes for the table, for wine, and for raisins had been grown fairly successfully in California before they were grown intensively in this valley. A beginning was made there in 1873, meeting with considerable success at first, but it was only with the introduction of co-operative marketing in 1913 that the present large production was reached. The factors favouring this spot are principally the climate and the facilities for irrigation. The aridity of the interior valley in summer and early autumn is essential for ripening and curing the grapes; at the same time abundant water is required in the spring and early summer. This is supplied by the streams of the western slopes of the Sierras, which are fed by the melting snows. This supply of pure water is at its maximum in July, the time it is most needed. The irrigated areas in Fresno county are fed almost entirely by Kings River, in the upper basin. This is due to the fact that, unlike the rivers of the lower basin, which have cut deep gorges, Kings River flows in a very shallow valley over the alluvial fans, so that there is little difficulty in getting the water on to the land. Incidental facts have also contributed to the supremacy of the Fresno area. The land was not found suitable for grain farming, so that there were no previously established interests, as in the lower basin, to oppose the introduction of vineyards on a large scale and the building of the necessary irrigation works. One or two raisin centres have been destroyed through neglect of drainage, causing flooding and the concentration of alkali in the soil, but Fresno has escaped this danger. It is calculated that there the maximum area to be irrigated by gravity-flow canals has very nearly been reached. In 1923, 265,000 tons of raisins were produced in California, more than twice the quantity produced in 1915. Weather conditions naturally influence the

size of the crop. During the April budding season a late frost would be serious, but this is likely to happen only one year in ten. Similarly the summer may be too hot, but this occurs very rarely. The critical period is the second half of August and early September: rain then would seriously affect the fruit. Out of 43 years, however, there has been no rain at this period in 27 years, while there was only a trace in 13. After being picked, the grapes are left to dry in the open for three weeks: the chances of bad weather conditions prevailing then are 1 in 8, and their effect is further discounted by the issue of meteorological forecasts. Co-operation among the cultivators has also diminished the danger from disease and pests. But the great factor in increasing production has been co-operation in controlling prices and nursing old and new markets. Formerly the growers were largely at the mercy of the middlemen, for the market was distant, freights were high, and demand was small or met by imports from abroad. Now, however, the amount of raisins imported into America is almost negligible, while a growing export trade is being built up, 45 per cent. of which goes to Canada and 33 per cent. to Great Britain.

AUSTRALIA

Power Resources of Australia.

Much detailed information on the power resources of Australia is to be found in the Report to the World Power Conference, London, 1924, prepared by the Institute of Engineers, Australia (Sydney, 1924). The chief Australian coal-measures are found along the eastern and south-eastern coast, and in the south-west corner of Western Australia—that is, in close proximity to the great centres of population. This has retarded considerably the development of the deposits of inferior coal, and also that of the water-power resources. The production figures for 1921 show the continued unchallenged supremacy of the New South Wales coalfield around Sydney. Of the 13 million tons produced in Australia, approximately 11 million came from New South Wales. Exports to foreign countries, exclusive of bunker coal, amounted to 1·6 million tons, of which practically all was exported from New South Wales through the port of Newcastle. The chief countries to which it went were New Zealand and the Dutch East Indies, followed at a considerable distance by the United States. The coal resources of New South Wales are estimated at 12,000 million tons, of which over half is of a high grade. At present the total Australian consumption is approximately 10 million tons per annum. The territories of Australia richest in water-power resources are Tasmania and Papua, and in Australia itself, the eastern and south-eastern slopes of the Australian Alps, the New England range, and the Blue Mountains. Their western slopes, besides being much drier, are also gentler. This coincidence with the coal area has retarded development. Further, the utilization of irrigation dams for hydro-electric power is difficult, from the irregular character of the supply. However, by co-ordination with other sources, it will be possible to overcome this obstacle, as for example in the Barren Jack irrigation scheme on the Murrumbidgee, where two 5000-kilowatt generators are being installed; the Sugar-loaf-Rubicon Scheme (Victoria), the power available being 25,000 H.P.; and in the Dawson Valley Irrigation project (Queensland), the second largest storage scheme in the world at present. Investigations as to the possibility of utilizing the great tidal range on the coast of Queensland are also being made. Tasmania has made the greatest use of water-power, being favoured by rainfall, and the steep descent from the central plateau. The estimated power is 700,000 H.P., of which about 10 per cent. has already been developed, the chief

works being at Waddamana, Lake Margaret, and Launceston. Since the initiation of the first in 1916, four principal industries have been established in Tasmania, dependent on hydro-electric power—the manufacture of electrolytic zinc, of calcium carbide, of woollen textiles, and of chocolates. In one case, a timber concern, with sufficient waste timber to generate the steam required, found it cheaper to install hydro-electric power and pay for the carting away of the waste. Up to the present no petroleum has been found in Australia, and the oil shale deposits are exceptionally small in relation to the coal-measures. Though not utilized at present, there is sufficient to supply the needs of the country at the present rate for thirty years. The only source from which any considerable supply of all classes of mineral oils could be obtained is to be found in the coal deposits, but the question is only now receiving attention.

GENERAL

New Light on Dampier's Voyage of 1703.

Our chief authority for Dampier's disastrous voyage of 1703 is the narrative published by his mate Funnell before the return of his captain, and this has been regarded as suspect to some extent on account of the disagreement that had occurred between the two men, and the accusations of inaccuracy brought against Funnell by Dampier in his subsequently published 'Vindication.' An unpublished document dealing with the voyage has lately come to light, and though it too constitutes an *ex parte* statement (being drawn up in support of an action at law proposed to be brought against Dampier and other defendants) any addition to the scanty material on which to base a judgment on the case is to be welcomed. The account has been preserved among the MS. papers of Mr. F. H. Goldney of Corsham, Wilts (an ancestor of whom, the Quaker merchant Thomas Goldney of Bristol, was one of the defendants in the proposed action), and having been lent by the owner to Dr. B. M. H. Rogers, has been summarized by the latter in the *Mariner's Mirror*, vol. 10, No. 4, October 1924. It sets forth in detail the circumstances under which the voyage was planned and the unfortunate disputes which took place between the associates who bore a part in it, to which disputes its miserable failure is to be attributed. We cannot here enter into details, but the general impression conveyed is distinctly unfavourable to Dampier, to whose pusillanimity the failure to secure prizes is ascribed throughout, and who is pictured as totally devoid of honour in his relations with the promoters of the venture. If the statements could be accepted as correct they would show that Dampier made up his mind to throw over the obligation to the owners and turn pirate on his own account. By the end of the voyage "the original agreement," as Dr. Rogers says, "had entirely broken down. Stradling had left after a quarrel; Clipperton had stolen a ship and deserted; Morgan, fearing to put a noose round his neck by turning pirate, had left; and now Funnell, disgusted with Dampier's incapacity, had sailed off, having had enough of what was to have been 'an absolute union and partnership.'" The grounds of the proposed action were the misapplication of funds due to Elizabeth Estcourt, sister and legatee of one of the promoters, and the fraudulent raising of money by a mortgage on her property to provide the means of fitting out the later venture in the *Duke* and *Dutchess* in 1708. It does not appear, however, that it ever came into court. It is impossible to say from whom the information as to the events of the voyage was obtained, but Dr. Rogers ventures the suggestion that it might have been had from John Ballot, the Surgeon of the *Cinque Ports* during the voyage.

Paintings and Photographs from the Mount Everest Expedition of 1924.

An exhibition of photographs from the Mount Everest Expedition, and of paintings and drawings by Mr. Francis Helps, is now open in the gallery of the Alpine Club, where the photographic records of the two earlier expeditions attracted many visitors. This year Captain Noel has confined himself rather strictly to subjects which were inadequately represented in former shows: especially the fantastic ice scenery of the East Rongbuk Glacier and the wonderful architecture of Kampa Dzong. The infinite variety of the pinnacles along the mysterious central trough becomes more remarkable each year the glacier is visited; and nothing more beautiful in ice-photography than the pictures shown at the Alpine Club gallery and the kinematograph film at the Scala Theatre has ever been produced. The fortress of Kampa is a puzzling building: some of Captain Noel's pictures give new and unexpected aspects that it is difficult to make fit with what we knew before: and still another surprise is given us in one of Mr. Somervell's paintings now shown in the exhibition room of the Society. Mr. Helps' paintings and drawings of Tibetans, Lepchas, Bhotias, and Nepalese are a new and very interesting feature of the exhibition. Some twenty-five large portraits in oils are painted in a good direct but not excessively modern style, and are well worth study. Many of the subjects, and some others, are represented also in the smaller pencil drawings. Mr. Helps worked in Sikkim and the Chumbi Valley. He has found very varied and interesting subjects, and we hope that the collection of native types may be preserved in some museum, perhaps in India.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1924-1925

Fifth Evening Meeting, 12 January 1924.—The President in the Chair.

ELECTIONS.—The Hon. Mrs. H. W. A. Adams; John Harold Burgess; Clifford Cartwright, B.SC.; Colonel William John Daniell Dundee, C.I.E.; Basil Beresford Griffin; Henry George Hamblin; Mohummud Faiyaz Khan; John Haydn Kirk, M.A.; Captain John Morland, R.I.M.; Tom Pearson; John Sydney Clunies Ross; Walter Stoneman, F.R.P.S.; Miss Margaret E. Tatton; Lieut. Arthur Geoffrey Gascoyne Webb, R.N. (retired).

PAPER: Animal Life at High Altitudes. Major R. W. G. Hingston.

Third Afternoon Meeting, 19 January 1924.—The President in the Chair.

PAPER.—The origin and movements of the Ross Barrier. C. S. Wright.

ARABIA

Routes between
'OQAIR AND JABRIN OASIS
in
EASTERN NEJD
from surveys by
MAJOR R. E. CHEESMAN O.B.E.
1923-24

Scale 1·750.000

MILES 10 5 0 10 20 30 MILES

Reference

Routes		*Sand desert*	
Camps	12·2·24	*Palm groves and cultivation*	
Heights in feet above sea level			457
Wells			

49°

25

To Kuwait

To Qatif

Qārat ar Rukban

Qattār

Al Wasiya

Ayūn

Kanzān

Al Gharaim

J. Kalābiya (J. Bursiqs)

J. Hawaira

Ain Umm al Saba'

To Jūda

Kalabiya

Halala

Mubarraz

Amm al Nam

Qāra

J. Qāra

Thaila

Dalwa

J. Abu Ghanima

20·11·23 · 9·2·24 & 1·3·24 · 4·3·24

HUFUF

Lat. 25° 22' 53" Long 49° 28' 39"

457

Pudhai

Jafar

Jisha

HASA OASIS

Khizam

Raunkiaer 1912

To Riyadh

Ruqaiqa

J. Malda

J. Arba' (Cliffs 150

J. Ghawār

Uthmāniya

Qasr Dalaiqiya

Sand dunes & bushes

J. Mutawi

J. Tamatain

Firm gravel

Ghār al Shuyūkh

Wadi al Batin

Soft sand dunes

Zarnūqa

10·2·24 & 27·2·24

Lat. 25° 03' 42"

J'Uwaisa

J. Kharma Zarnūqa

Hard gravel plain

Bushes

J. Sharja

J. Burūj al Majār

J. Huwaitiya

Janah Jāfūra

12·2·24

Hasa Jāfūra boundary

Dunes 40 ft high

Bushes

Soft dunes 20 ft high

Sandy plain

Bushes

J. Burūj al Hasan

J. Dharābīn

13·2·24 & 26·2·24

Leachman 1912

Philby 1917

To Riyadh

J. Harmaliya

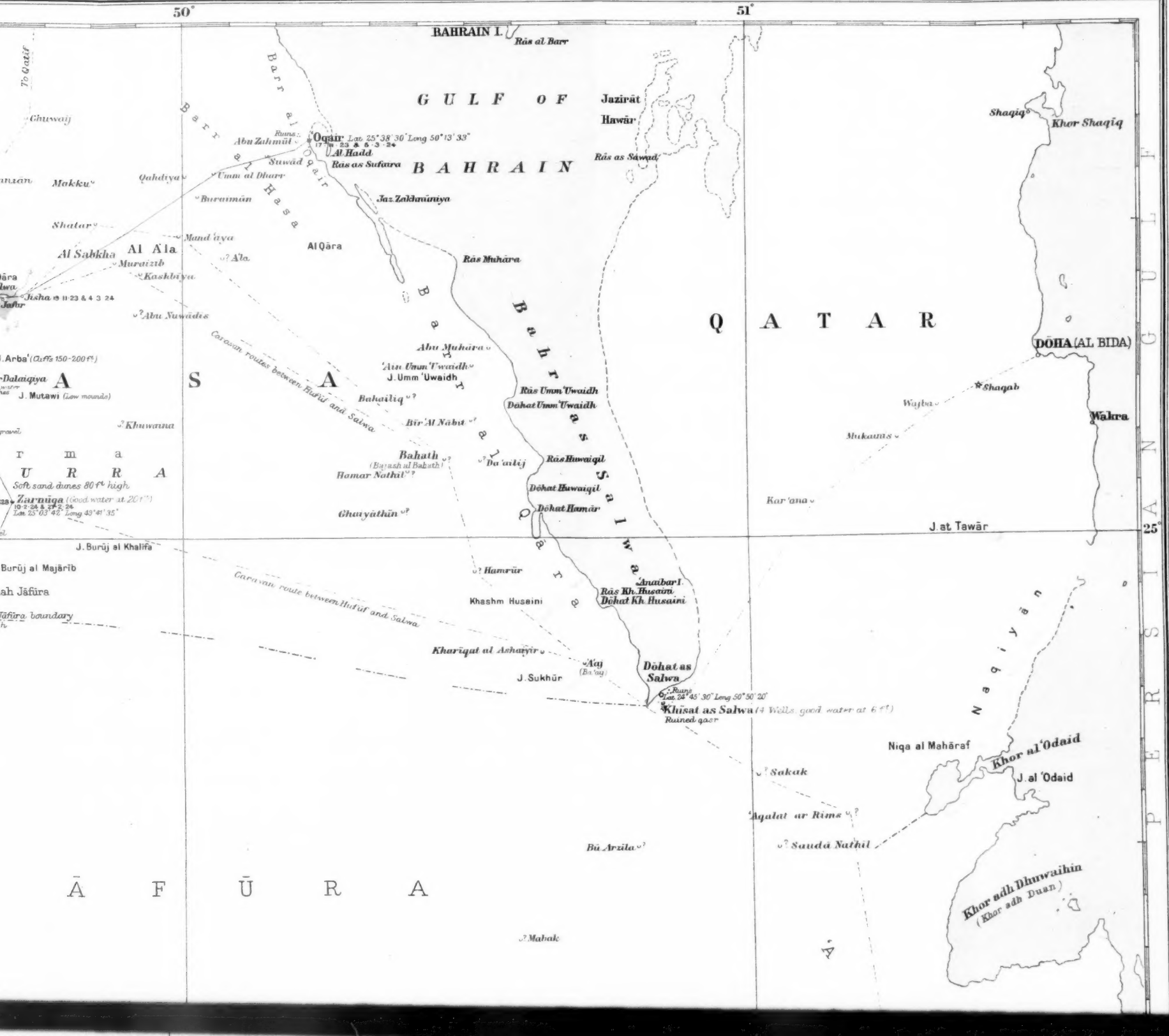
(Limestone mounds)

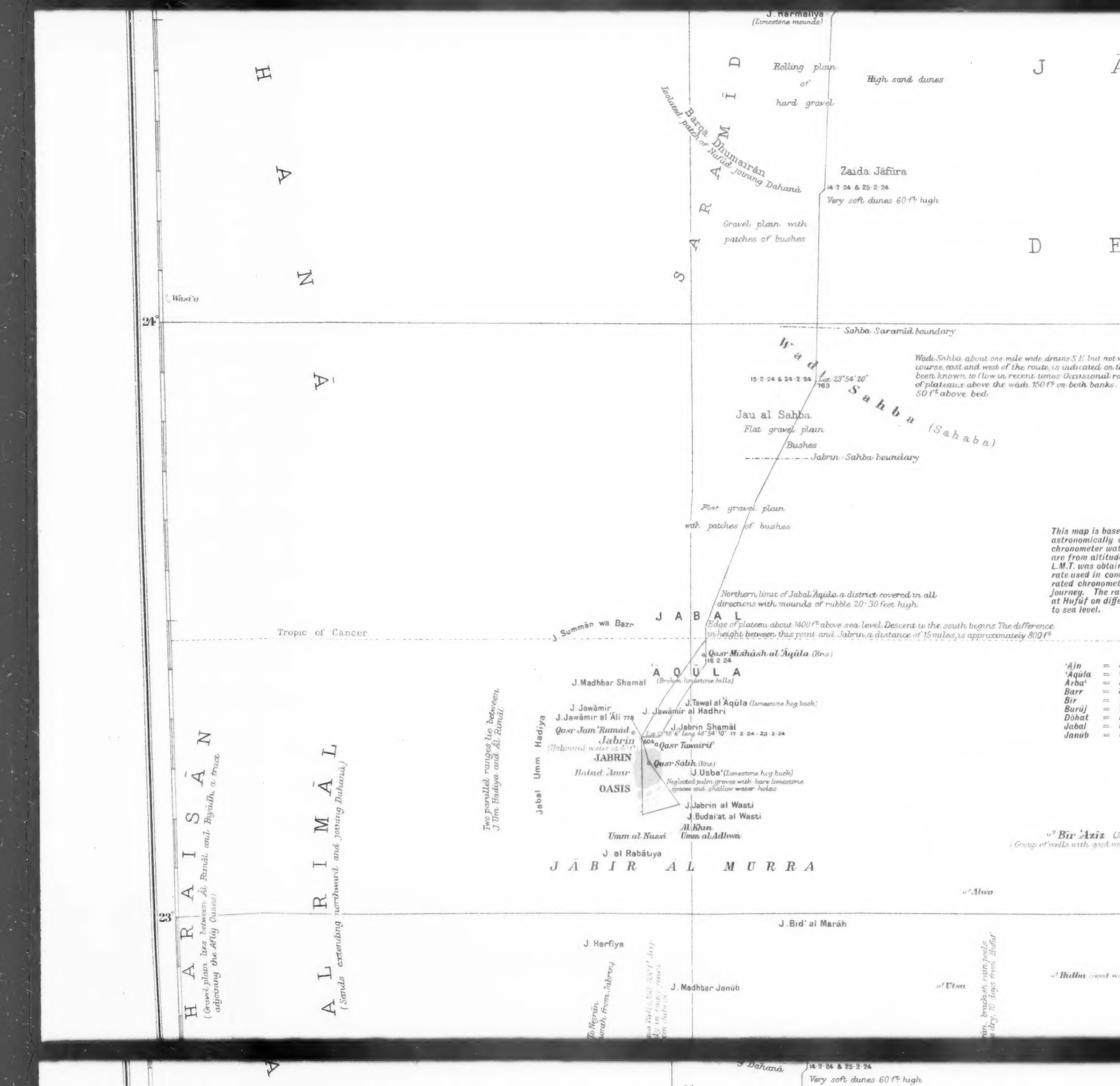
Rolling plain of hard gravel

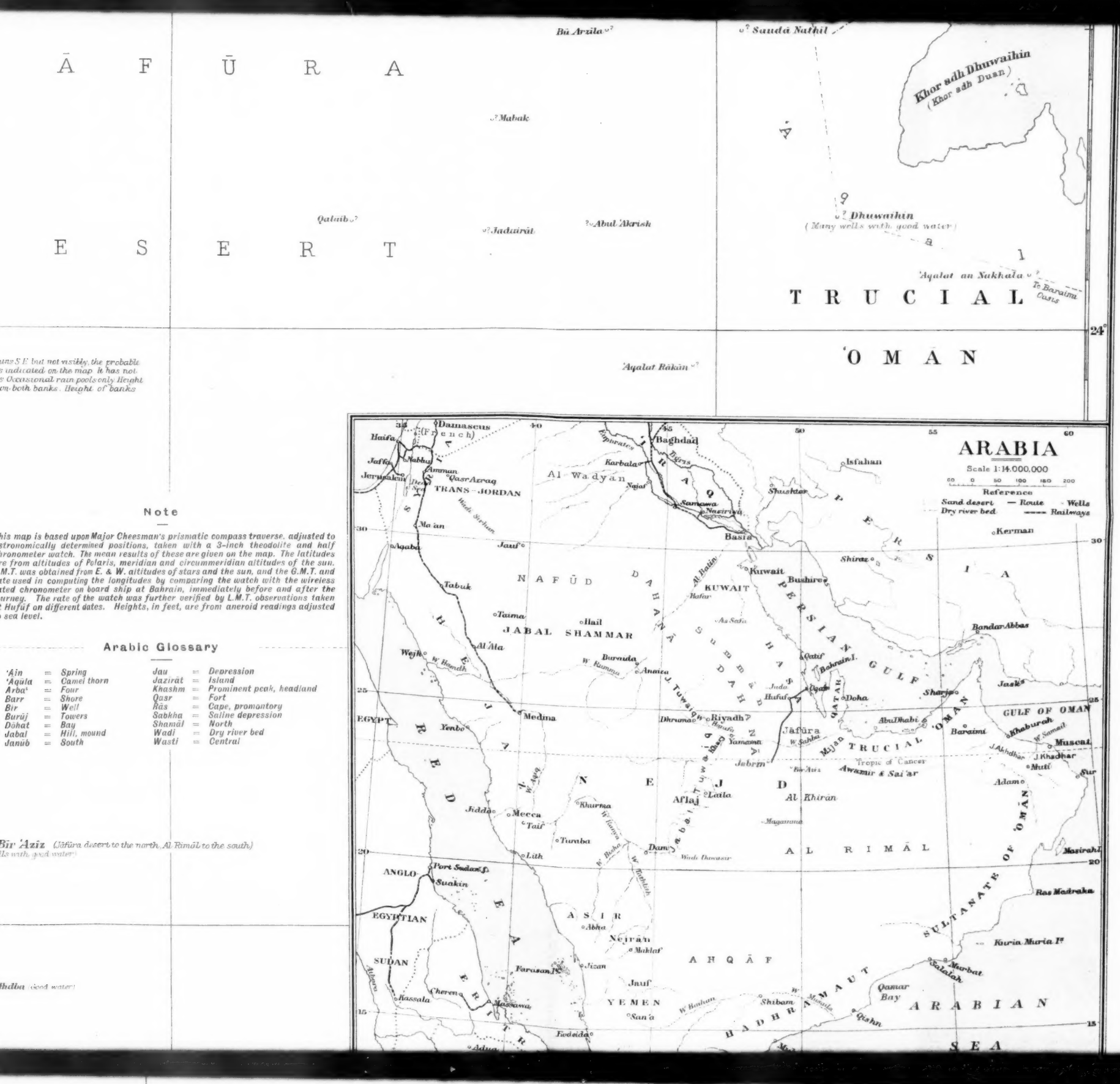
High sand dunes

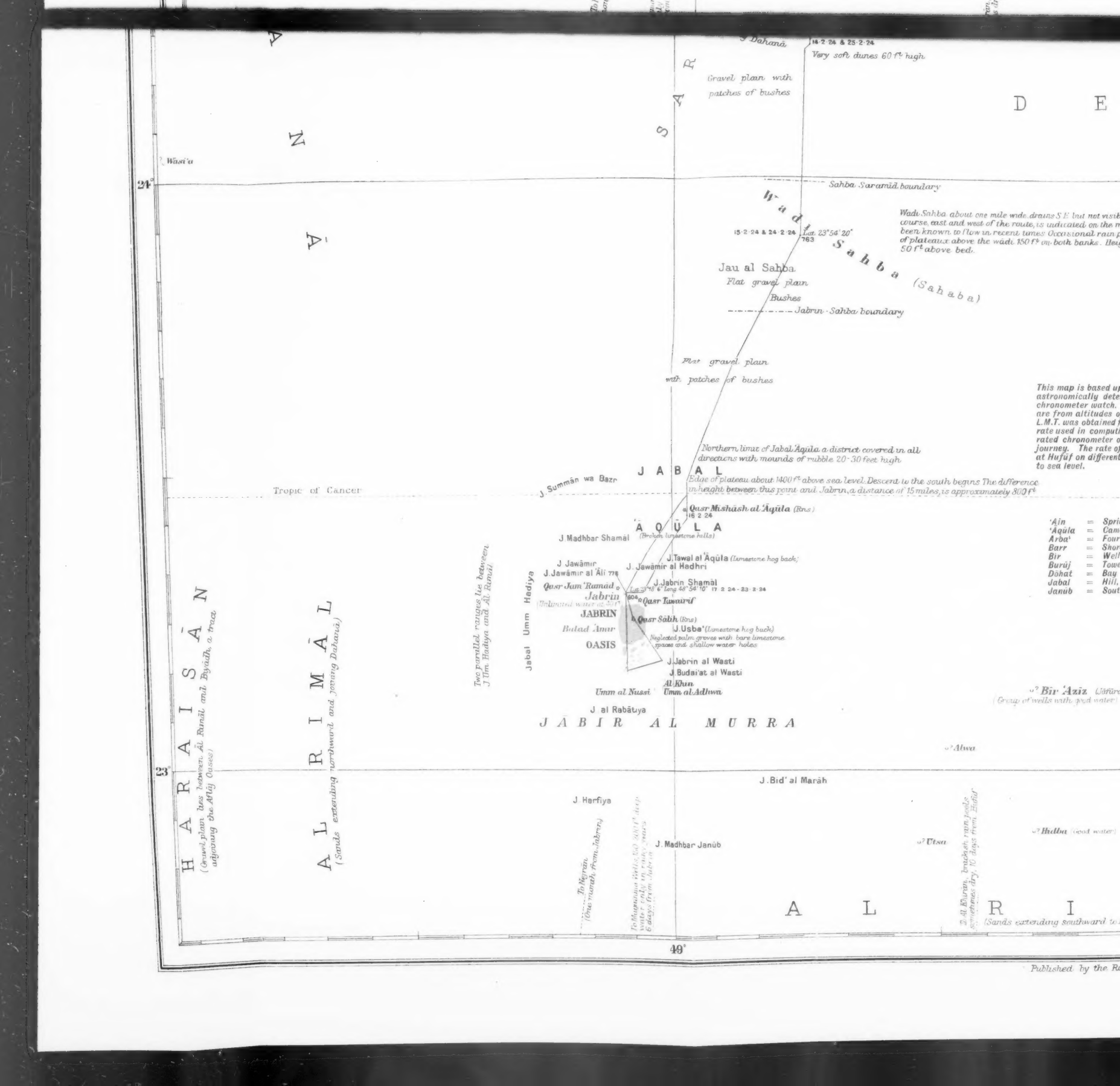
Isolated patch of Nufud

Barqa Dhumair


50°
51°
25°
BAHRAIN I.
Rās al Barr
GULF OF
Jazirāt
Hawār
Rās as Sawad
BAHRAIN
Barr al Hasa
Qair
Ruins
Abu Zahmil
Oqair Lat. 25°38'30" Long 50°13'33"
Al Haid
Rās as Sufaira
Jaz Zakhamāniya
Rās Muhāra
Al Qāra
Al Sabkha
Al 'Ala
Muraizib
Kashbiya
Mand'iya
Shaqiq
Khor Shaqīq
QATAR
DŌHA (AL BIDA)
Shaqab
Wakra
Wajba
Mukainas
Kar'ana
J. at Tawār
Bahrain
Qa'ara
Abu Muhāra
'Ain Umm 'Uwaidh
J. Umm 'Uwaidh
Rās Umm 'Uwaidh
Dōhat Umm 'Uwaidh
Bahailiq
Bir 'Al Nābi
Bahath
(Bajash al Bahath)
Hamar Nathil
Da'ailij
Rās Huwaiqil
Dōhat Huwaiqil
Dōhat Hamār
Ghuyāthīn
Hamrūr
Anaibar I.
Rās Kh. Husaini
Dōhat Kh. Husaini
Khashm Husaini
Kharīqat al Ashayir
'Aaj
(Ba'aq)
J. Sukhūr
Dōhat as Salwa
Ruins
Lat. 24°45'30" Long 50°50'20"
Khisat as Salwa (4 Wells, good water at 6 ft.)
Ruined qasr
Niqa al Mahāraf
Khor al 'Odaid
J. al 'Odaid
Sakak
'Aqalat ar Rims
Sauda Nathil
Bū Arzila
Mabak
Khor adh Dhuwaihin
(Khor adh Duan)
Naqiyan
PERSIAN GULF
Ghuwaij
Makku
Qahdiya
Umm al Dharr
Buraimān
Shatar
Jisha
Jafar
Abu Nuwādis
Arba' (Cliffs 150-200 ft.)
Dalaiqiya
J. Mutawi (Low mounds)
Khuwaina
Soft sand dunes 80 ft. high
Zarnūqa (Good water at 20 ft.)
Lat. 25°03'42" Long 49°41'35"
J. Burūj al Khalifa
Burūj al Majārīb
Jāfūra
Jāfūra boundary
Caravan routes between Hufūf and Salwa
Caravan route between Hufūf and Salwa
ĀFŪRA


J. Harmaliya
(Limestone mounds)
Rolling plain of hard gravel
High sand dunes
Barqa Dhumairān
Isolated patch of Hafūd forming Dahanā
Zaida Jāfūra
14·2·24 & 25·2·24
Very soft dunes 60 ft high
Gravel plain with patches of bushes
Wasi'a
24°
Sahba Saramīd boundary
Wadi Sahba about one mile wide, drains S.E. but not
course, east and west of the route, is indicated on t
been known to flow in recent times. Occasional ra
of plateaux above the wadi. 150 ft on both banks.
50 ft above bed.
15·2·24 & 24·2·24
Lat. 23°54'20"
763
Jau al Sahba
Flat gravel plain
Bushes
Jabrin-Sahba boundary
Wadi Sahba (Sahaba)
Flat gravel plain with patches of bushes
This map is base
astronomically
chronometer wat
are from altitud
L.M.T. was obtai
rate used in com
rated chronomet
journey. The ra
at Hufuf on diffe
to sea level.
Northern limit of Jabal 'Āqūla, a district covered in all directions with mounds of rubble 20-30 feet high.
Edge of plateau about 1400 ft above sea level. Descent to the south begins. The difference in height between this point and Jabrin, a distance of 15 miles, is approximately 800 ft.
Tropic of Cancer
J. Summān wa Bazr
J A B A L
Qasr Mishāsh al 'Āqūla (Rns.)
16·2·24
'Ā Q Ū L A
(Broken limestone hills)
'Ain
'Aqūla
Arba'
Barr
Bir
Burūj
Dōhat
Jabal
Janūb
J. Madhbar Shamal
J. Jawāmir
J. Jawāmir al 'Ali 778
J. Jawāmir al Hadhri
J. Tawal al 'Āqūla (Limestone hog back)
Qasr Jam'Ramād
Jabrin
(Unlimited water at 40')
Lat. 23°16' & long. 48°24'10" 17·2·24 - 23·2·24
604
Qasr Tuwairif
JABRIN
OASIS
Hulad Āmir
Qasr Sālih (Rns.)
J. Usba' (Limestone hog back)
Neglected palm groves with bare limestone spaces and shallow water holes
J. Jabrin Shamāl
J. Jabrin al Wasti
J. Budai'at al Wasti
Al Khan
Umm al Nusi
Umm al Adhwa
J. al Rabātiya
J Ā B I R Ā L M U R R A
Jabal Umm Hadiya
Two parallel ranges lie between J. Um Hadiya and Al Ramāl.
Bir 'Azīz
(Group of wells with good wa
Atwa
J. Bid' al Marāh
J. Harfiya
J. Madhbar Janūb
Utsa
Hulba (Good wa
To Nejrān.
Sarah. From Jabrin
H A R A I S Ā N
(Gravel plain lies between Al Ramāl and Byāidh, a trac
adjoining the Afāj Oases)
A L R I M Ā L
(Sands extending northward and joining Dahanā)
A N
H A
S A R A M Ī D
Dahanā
14·2·24 & 25·2·24
Very soft dunes 60 ft high


ĀFŪRA
ESERT
Bū Arzila
Mabak
Qalaib
Jadairāt
Abul 'Akrish
Saudā Nathil
Khor adh Dhuwaihin
(Khor adh Duan)
Dhuwaihin
(Many wells with good water)
'Aqalat an Nakhala
To Baraima Coasts
TRUCIAL
'OMĀN
'Aqalat Rākān
uns S.E. but not visibly, the probable
s indicated on the map. It has not
s. Occasional rain pools only. Height
on both banks. Height of banks
Note
his map is based upon Major Cheesman's prismatic compass traverse, adjusted to
stronomically determined positions, taken with a 3-inch theodolite and half
hronometer watch. The mean results of these are given on the map. The latitudes
re from altitudes of Polaris, meridian and circummeridian altitudes of the sun.
M.T. was obtained from E. & W. altitudes of stars and the sun, and the G.M.T. and
ate used in computing the longitudes by comparing the watch with the wireless
ated chronometer on board ship at Bahrain, immediately before and after the
urney. The rate of the watch was further verified by L.M.T. observations taken
Hufūf on different dates. Heights, in feet, are from aneroid readings adjusted
sea level.
Arabic Glossary
'Ain = Spring
'Aqula = Camel thorn
Arba' = Four
Barr = Shore
Bir = Well
Burūj = Towers
Dōhat = Bay
Jabal = Hill, mound
Janūb = South
Jau = Depression
Jazirāt = Island
Khashm = Prominent peak, headland
Qasr = Fort
Rās = Cape, promontory
Sabkha = Saline depression
Shamāl = North
Wadi = Dry river bed
Wasti = Central
Bir 'Aziz (Jāfūra desert to the north, Al Rimāl to the south)
ls with good water)
hdiba (good water)
ARABIA
Scale 1:14,000,000
Reference
Sand desert — Route · Wells
Dry river bed ---- Railways
Damascus
(French)
Haifa
Jaffa
Nablus
Amman
Jerusalem
Dead Sea
Qasr Azraq
TRANS-JORDAN
Wadi Sirhan
Ma'an
Aqaba
Jauf
Tabuk
Tiama
Hail
JABAL SHAMMAR
Al 'Ula
Wejh
W. Hisandh
Euphrates
Baghdad
Tigris
Karbala
Najaf
Al Wadyan
Samawa
Nasiriya
Basra
NAFŪD DAHANA
Al Batin
Hafar
KUWAIT
Kuwait
Bushire
Isfahan
Shushtar
Shiraz
Kerman
PERSIA
PERSIAN GULF
Bahrain I.
Qatif
Jubail
Hufuf
Qatar
Doha
Bandar Abbas
Jask
Sharjo
Abu Dhabi
Buraida
Anaiza
W. Rummah
W. Tuwaiq
Dhruma
Riyadh
Hanifa
Wadi Hanifa
Yamama
W. Sahba
Jāfūra
Mijad
TRUCIAL
'OMAN
GULF OF OMAN
Baraimi
Khaburah
W. Samail
Muscat
J. Akhdhar
J. Khadhar
Muti
Sur
Adam
Jabrin
Tropic of Cancer
Awazir & Sai'ar
Aflaj
Laila
AN NEFUD
Al Khiran
Maganama
AL RIMĀL
Wadi Dawasir
Masirah I.
Ras Madraka
SULTANATE OF 'OMAN
Kuria Muria Is.
Marbat
Salalah
Qamar Bay
ARABIAN SEA
Qishn
HADHRAMAUT
Shibam
W. Hadhramaut
W. Masila
W. Baihan
Jauf
YEMEN
San'a
Hodeida
Aden
Medina
Yenbo
EGYPT
RED SEA
Jidda
Mecca
Taif
Turaba
Khurma
W. Khurma
W. Bisha
Lith
Port Sudan
Suakin
ANGLO-EGYPTIAN SUDAN
Abu Ramad
Cheren
Kassala
Massawa
Farasan Is.
Jizan
ASIR
Abha
Najran
Muklaf
AHQĀF
Wadi Mahlah
W. Bana
W. Jizan
Abiara
Wadi Hadhramaut
Wadi Dawasir
Wadi Rummah
Wadi Sirhan
Wadi Hisandh
Wadi Bisha
Wadi Jizan
Wadi Baihan
Wadi Masila
Wadi Hanifa
Wadi Sahba
Wadi Samail
Wadi Akhdhar
Wadi Khadhar
Wadi Abiara
Wadi Mahlah
Wadi Jizan
Wadi Baihan
Wadi Masila


Bahana
14·2·24 & 25·2·24
Very soft dunes 60 ft high
Gravel plain with patches of bushes
D E
Wasi'a
24°
Sahba-Saramid boundary
Wadi Sahba about one mile wide, drains S.E. but not visib
course, east and west of the route, as indicated on the m
been known to flow in recent times. Occasional rain p
of plateaux above the wadi. 150 ft on both banks. Hei
50 ft above bed.
15·2·24 & 24·2·24
Lat. 23°54'20"
763
Wadi Sahba (Sahaba)
Jau al Sahba
Flat gravel plain
Bushes
Jabrin-Sahba boundary
Flat gravel plain
with patches of bushes
This map is based u
astronomically dete
chronometer watch.
are from altitudes o
L.M.T. was obtained
rate used in computi
rated chronometer o
journey. The rate o
at Hufūf on different
to sea level.
Northern limit of Jabal 'Āqūla, a district covered in all directions with mounds of rubble 20-30 feet high
J. Summān wa Bazr
J A B A L
Edge of plateau about 1400 ft above sea level. Descent to the south begins. The difference in height between this point and Jabrin, a distance of 15 miles, is approximately 800 ft
Tropic of Cancer
Qasr Mishāsh al 'Āqūla (Rns)
16 2 24
A Q Ū L A
'Ain = Spri
'Āqūla = Cam
Arba' = Four
Barr = Shor
Bir = Well
Burāj = Towe
Dōhat = Bay
Jabal = Hill,
Janūb = Sout
J. Madhbar Shamāl (Broken limestone hills)
J. Jawāmir
J. Jawāmir al 'Ali 778
J. Tawal al 'Āqūla (Limestone hog back)
J. Jawāmir al Hadhri
Qasr Jum'Ramād
Jabrin
(Unlimited water at 30ft)
J. Jabrin Shamāl
Lat 23°48' 6" Long 48°54'10" 17·2·24 - 23·2·24
804
Qasr Tuwairif
JABRIN
OASIS
Qasr Sābih (Rns)
Bulad Amir
J. Usba' (Limestone hog back)
Neglected palm groves with bare limestone spaces and shallow water holes
J. Jabrin al Wasti
J. Budai'at al Wasti
Al Khun
Umm al Nussi
Umm al Adhwa
J. al Rabātuya
J A B I R A L M U R R A
Bīr 'Azīz (Artésie
(Group of wells with good water)
Alwa
H A R A I S Ā N
(Gravel plain lies between Al Rimāl and Byāth, a trac
adjoining the Āflaj Oases)
A L R I M Ā L
(Sands extending northward and joining Dahana)
Two parallel ranges lie between J Um Hadiya and Al Rimāl
Jabal Umm Hediya
23°
J. Bid' al Marāh
J. Herfiya
To Nayrān
(One month from Jabrin)
To Mugadiya (Hofuf) 500 ft dee
wells 4 ft in diameter
6 days from Jabrin
J. Madhbar Janūb
Utsa
Hidba (Good water)
S. Al Khuran, brackish rain pools
sometimes dry. 10 days from Hufūf
A L R I
(Sands extending southward to
49°
Published by the Ra

E S E R T

Qatāb

Jadairāt

Abul 'Akrish

Dhuwaihin
(Many wells with good water)

'Aqalat an Nakhaila

To Baraimi Oasis

T R U C I A L

24°

'O M Ā N

S.E. but not visibly, the probable
dicated on the map. It has not
casional rain pools only. Height
oth banks. Height of banks

'Aqalat Rākān

Note

map is based upon Major Cheesman's prismatic compass traverse, adjusted to
nomically determined positions, taken with a 3-inch theodolite and half
nometer watch. The mean results of these are given on the map. The latitudes
rom altitudes of Polaris, meridian and circummeridian altitudes of the sun.
. was obtained from E. & W. altitudes of stars and the sun, and the G.M.T. and
used in computing the longitudes by comparing the watch with the wireless
chronometer on board ship at Bahrain, immediately before and after the
ey. The rate of the watch was further verified by L.M.T. observations taken
fūf on different dates. Heights, in feet, are from aneroid readings adjusted
a level.

Arabic Glossary

in	= Spring	Jau	= Depression
qūla	= Camel thorn	Jazirāt	= Island
ba'	= Four	Khashm	= Prominent peak, headland
rr	= Shore	Qasr	= Fort
r	= Well	Ras	= Cape, promontory
rūj	= Towers	Sabkha	= Saline depression
hat	= Bay	Shamāl	= North
bal	= Hill, mound	Wadi	= Dry river bed
nūb	= South	Wasti	= Central

'Aziz (Jāfūra desert to the north, Al Rimāl to the south)
th good water)

ha (good water)

I M Ā L
southward to Hajrān)

50°

ARABIA
Scale 1:14,000,000
60 0 60 120 180 200
Reference
Sand desert — Route · Wells
Dry river bed ---- Railways

Damascus (French)
Haifa
Jaffa
Nablus
Amman
Jerusalem
Dead Sea
Qasr Azraq
TRANS-JORDAN
Wadi Sirhan
Ma'an
Aqaba
Jauf
Tabuk
Taima
Hail
JABAL SHAMMAR
Al 'Ula
Wejh
W. Hizandh
Burauda
W. Rumma
Anaiza
NAFŪD DAHANA
Al Batin
KUWAIT
Kuwait
Bushire
Euphrates
Baghdad
Karbala
Najaf
Al Wadyan
Tigris
Samawa
Nasiriya
Shushtar
Isfahan
Kerman
Shiraz
Bandar Abbas
Qatif
Bahrain I.
Dhahran
Dammam
Jubail
Uqair
Doha
Sharja
Jask
Abu Dhabi
Baraimi
Khaburah
Muscat
Sur
Adamo
Mazirah I.
Ras Madraka
Kuria Muria Is.
Marbat
Salalah
Qamar Bay
Qishn
Mukalla
Socotra
GULF OF OMAN
SULTANATE OF 'OMAN
ARABIAN SEA
PERSIAN GULF
IRAN
Sumeisma
Jafūra
Mujan
TRUCIAL
Tropic of Cancer
Awamir & Sai'ar
Jebrin
Riyadh
Dhrumae
Yamama
Layla
Aflaj
Al Khirān
Magamma
AL RIMĀL
Wadi Dawasir
Sabakhat Umm al Sahik
Khurma
Turaba
Lith
Jiddah
Mecca
Taif
Yenbo
Medina
EGYPT
RED SEA
NEJD
Wadi Hanifa
W. Baha
W. Turbah
Dam
ASIR
Abha
Najran
Maklaf
Farasan Is.
Jizan
AHQĀF
HADHRAMAUT
Shibam
W. Hadhramaut
Masila
Jauf
YEMEN
San'a
W. Rahaw
Hodeida
Mocha
Taiz
Aden
GULF OF ADEN
Perim
Bab al Mandab
Port Sudan
Suakin
ANGLO-EGYPTIAN SUDAN
Khor Nasala
Cherena
Massawa
Adua
ABYSSINIA
Gondar
L. Tsana
ERITREA

Published by the Royal Geographical Society

ARABIA
Cheesman